U.S. Army
Program Manager for
Chemical Demilitarization

Guide to
Risk Management Policy
and Activities

Rev. 0

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FOREWORD

Although issued as a final document, this guide will be updated in future revisions to reflect enhancements to the risk management program. In particular, the assessment of facility changes described in section 7 includes a public participation process. This guide discusses a proposal for the public's involvement in the change evaluation, but the final form of that participation process will be decided after further input is obtained from the public. A revision to this report will be issued if there are changes to the public participation process proposed here.

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A GUIDE TO
RISK MANAGEMENT POLICY AND ACTIVITIES

The U.S. Chemical Stockpile Disposal Program (CSDP) was established to safely dispose of the U.S. stockpile of unitary chemical weapons at eight continental U.S. (CONUS) sites and a site located on Johnston Island in the Pacific Ocean. CSDP was created in response to Public Law (PL) 99-145, which was passed by Congress in November 1985. A fundamental objective in this mission is to ensure that risks associated with the disposal processes are managed and that maximum protection of the health and safety of the public and workers as well as environmental protection are provided.

This guide describes the ongoing risk management program implemented by the Program Manager for Chemical Demilitarization (PMCD) to manage the risks of chemical weapons disposal. This guide is intended for PMCD personnel, and its purpose is to:

- Define risk management and its associated concepts (section 1)
- Describe PMCD's risk management policy (section 2)
- Provide an overview of PMCD risk management functions and activities (section 3)
- Define PMCD risk management activities:
    - Assessment (section 4)
    - Requirements (section 5)
    - Monitoring (section 6)

  - Management of change (section 7)
  - Public participation (section 8)

- Summarize organizational responsibilities for risk management (section 9).

Section 10 is a summary. Acronyms are defined in appendix A, and a risk management glossary is provided as appendix B to promote the use of a common terminology. Appendix C addresses activities undertaken to assess offsite consequences, which is a special topic important to program integration. Finally, appendix D contains guidance excerpted from the Code of Federal Regulations pertaining to Resource Conservation and Recovery Act permit modifications.

Summary information is provided in this report, and other sources are referenced for more detailed information on specific activities. Interrelationships among risk management activities are especially highlighted.

SECTION 1
OVERVIEW

The combined activities of PMCD ensure a comprehensive approach to risk management. It is the purpose of this guide to provide the reader with an understanding of all risk management activities. This section provides an overview by answering questions that might be raised about risk management activities. The remaining sections of the report expand on the answers provided in this overview.

What is risk?

Risk is a measure of loss or harm that could result from chemical weapons storage or disposal operations. Risk is a function of the frequency and severity of the loss.

What risks need to be considered?

Various potential risks to life and health of humans and to the environment are considered and are best categorized by who or what is affected:

- Risk to the public in the vicinity of chemical weapons storage and disposal sites
- Risk to the disposal process workers and other workers on the sites
- Risk to equipment/facility operability
- Risk to the environment, including air, water, flora, and fauna.

Potential health risks must include consideration of immediate effects or any potential for delayed or chronic effects. This guide addresses management of all of these risks.

The term “risk” is also used to describe “programmatic risks” associated with schedule delays and cost growth. Programmatic risks differ from the safety and environmental risks listed above and are not addressed explicitly in this guide (although they are mentioned in the context of the change evaluation process described in section 7). Programmatic risks are monitored and managed through means discussed in other documentation (USACMDA, 1994).

What hazards cause these risks?

Hazards are conditions or materials that cause the potential for loss or harm. In this program, several types of hazards must be addressed:

- Chemical agent
- Energetics (propellant and explosives)
- Industrial hazards including other chemicals and materials (for example, caustics)
- Occupational hazards including physical hazards (for example, moving equipment) and other workplace conditions that could result in injury
- Pollutants or emissions.

This guide discusses the measures in place to manage the risks associated with each of these types of hazards.

What does PMCD do to manage these risks?

Given that the disposal of chemical weapons and their agents involves inherent hazards, it is the responsibility of PMCD to minimize the risks. The sum of all activities conducted to minimize risks is termed *risk management*. This guide describes PMCD’s policy and activities that are associated with risk management. In order to achieve

successful risk management, PMCD must understand hazards and risks through assessments and, based on that understanding, manage the risks through specific activities.

When does PMCD perform risk management?

Risk management is a life-cycle activity, initiated at the beginning of the program and continuing through the elimination of chemical weapons and agent and decommissioning of all disposal facilities. Safety analyses under the auspices of Army regulations were performed at even the earliest design and development stages.

What does PMCD do to understand risks?

PMCD has developed the disposal process with a continuous emphasis on the need for safe operation. Specific activities are undertaken to understand potential hazards and risks, which can be categorized as follows:

- Hazard evaluation (HE)
- Resource Conservation and Recovery Act (RCRA) Part B risk assessment including:
    - Human health risk assessment [HHRA, but usually called health risk assessment (HRA)]
    - Ecological risk assessment (ERA)
- Quantitative risk assessment (QRA)
- Environmental impact statement (EIS).

The objectives and scope of each of these assessments are discussed in section 4.

How are risk management decisions made?

Risks are first understood through the assessments described above, and then decisions are made regarding the acceptability of the level of risk. PMCD does this through comparison to regulated acceptance criteria and through an authority matrix that specifies the management level required to authorize acceptance of a given level of risk. Public participation and input are also used in the decision-making process. Sections 5.3 and 7.1 describe risk decision-making in more detail.

Who is responsible for risk management?

Risk management can be understood through the various functions that PMCD performs:

- Design and construction
- Systemization and operations
- Safety
- Environmental protection
- Emergency preparedness
- Public outreach.

PMCD performs the functions of risk management and is organized accordingly. The PMCD organizational groups directly responsible for risk management functions are the Engineering and Support Division, Operations Division, Risk Management and Quality Assurance Office (including safety), Environmental and Monitoring Office, Project Manager for Chemical Stockpile Emergency Preparedness, and Public Information and Outreach Office (including public participation). Each office and division has responsibilities directed toward these functions, some direct and some supportive. The relationship of PMCD offices and divisions to these functions is described in section 9. Each of the individual chemical agent disposal facilities (CDFs) is operated by a contractor who has further responsibilities for executing the policies of the Army and PMCD, as well as meeting its own requirements for risk management.

How does PMCD manage risk?

Through the functions of risk management described above, PMCD pursues activities that together make up risk management. These activities are:

- Risk assessment, to understand risk
- Requirements, to control and minimize risk
- Monitoring, to continuously ensure the effectiveness of control measures
- Management of change, to maintain safety throughout the life cycle
- Public participation, to ensure that members of the public are involved and informed.

How are interfaces with communities for emergency management handled?

Part of the commitment to maximum protection mandated by PL 99-145 was an agreement between the Army and the Federal Emergency Management Agency (FEMA) that established the Chemical Stockpile Emergency Preparedness Program, now termed a Project (CSEPP). CSEPP is implemented at the state and local (county) level. It provides for the planning, training, coordination, and improvements associated with preparedness for possible emergencies related to chemical weapons.

How is risk information shared with the public?

The Public Information and Outreach Office of PMCD has ongoing activities to inform the public and to gather information from the public for use in risk management.

What requirements apply to safety risk?

PMCD safety management is implemented under the auspices of military and Army regulations in safety (DA, 1988), chemical safety (DA, 1992), and system safety (DoD, 1993; DA, 1990). PMCD also manages safety risk for the CSDP and CDFs

according to the requirements for occupational and process safety management mandated by the Occupational Safety and Health Administration (OSHA) (OSHA, 1993).

What requirements apply to environmental risk?

Each CDF falls under the auspices of federal and state Environmental Protection Agency (EPA) regulations. In particular, each CDF must be permitted under RCRA, Part B. Also, PL 99-145 (PL, 1986) requires coordination with the EPA, and Executive Order 12088 requires all federal agencies to comply with all applicable pollution control standards and secure permits and approvals as would any private activity. The disposal process must also meet the requirements of the National Environmental Policy Act (NEPA) (PL 91-190), as well as requirements listed in the Final Programmatic Environmental Impact Statement (FPEIS), for example, the Toxic Substances Control Act (TSCA), the Clean Air Act, and the Clean Water Act.

SECTION 2
PMCD RISK MANAGEMENT POLICY

The PMCD policy for managing risks during the disposal of chemical weapons has been developed from classical risk management principles (for example, Covello, 1985; Keeney, 1995; Morgan, 1993; Nathwani, 1995; Somers, 1995; Van Mynen, 1990) including regulations from the military (DA, 1990) and industry (OSHA, 1993; USEPA, 1996). The PMCD safety policy (PMCD, 1996d) establishes the overriding focus on safety that is inherent to risk management. In summary, the policy states that:

> The Chemical Demilitarization Program's primary objective is to destroy the Nation's unitary lethal chemical munitions stockpile while ensuring that the maximum protection of the public, workforce, and the environment is provided.

and,

> PMCD's continued commitment to safety is the primary responsibility of each PMCD employee, supporting contractor, and chemical disposal facility operating contractor associated with the Chemical Demilitarization Program.

The PMCD risk management policy may be summarized as consisting of the following objectives:

- Operate the CDFs in a manner that protects the environment and the health and safety of workers and the public

- Incorporate risk management into its major functions — design and construction, systemization and operations, safety, environmental protection, emergency preparedness, and public participation

- Develop program management systems to ensure commitment to and efficient performance of risk management in all areas

- Use traditional risk management strategies — inherent safety, accident prevention, risk reduction, risk mitigation, and accident preparedness. Thorough efforts in all of these areas establish layers of protection to best ensure risk minimization.

- Develop effective safety cultures at each operation site, and ensure that they remain effective for the entire project life

- Base risk management decisions on the latest in risk assessment technology

- Implement risk strategies, perform risk management functions, and implement risk management activities

- Commit to and implement a program of public participation. This involves two-way communication with the public, including public outreach and risk perception issues.

SECTION 3

OVERVIEW OF RISK MANAGEMENT FUNCTIONS AND ACTIVITIES

The goal of PMCD management is to establish CDFs that are safe relative to the public, the workers at the facilities, and the environment. This is accomplished through risk management activities that are carried out within management functions.

3.1 Risk Management Functions

The functions of risk management are integrated in the normal functioning of the CDF and the Project Manager for Chemical Stockpile Disposal (PMCSD)/PMCD as shown in figure 1. Each CDF will be responsible for implementing risk-based insights and authority.

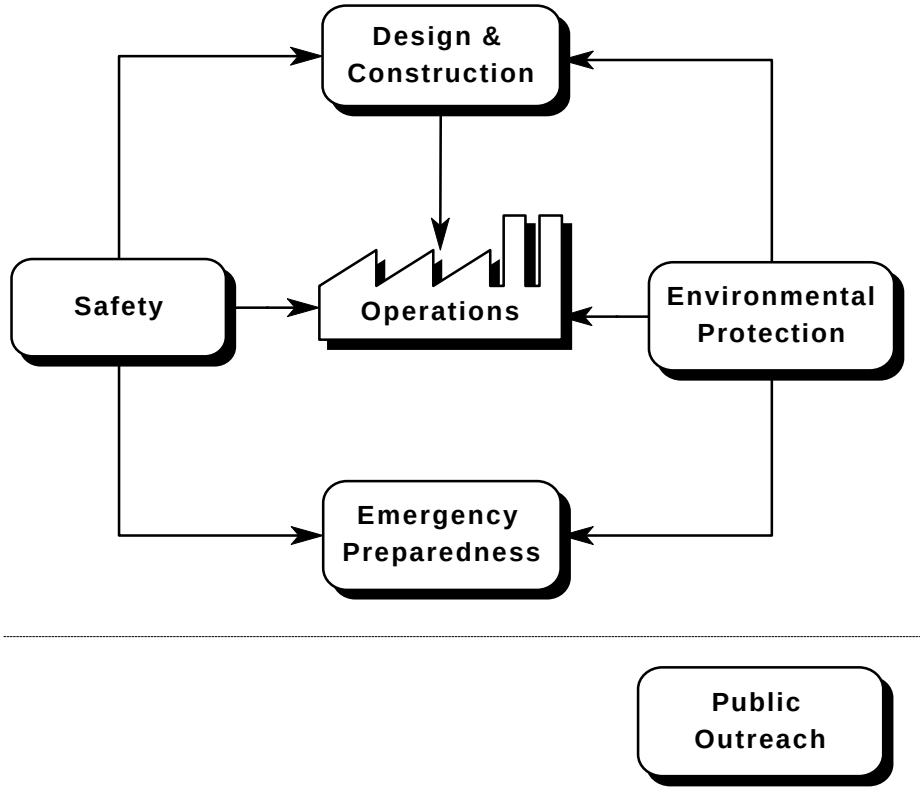

Figure 1. PMCD Risk Management Functions

Risk management is implemented through six general functions: design and construction, systemization and operations, safety, environmental protection, emergency preparedness, and public outreach. The first two functions involve other elements besides risk management, whereas the next three are dedicated to risk management. The last function is at the interface of technical and programmatic risk management, being an important two-way communication with the stakeholders local to the CDFs.

1. *Design and Construction.* This function has been ongoing since the onset of CSDP. The prototype Johnston Atoll Chemical Agent Disposal System (JACADS) and the newly online Tooele Chemical Agent Disposal Facility (TOCDF) were designed based on preliminary and later more mature risk assessments. All of the basic environmental compliance and safety requirements are established in this function.

2. *Systemization and Operations.* Systemization and operations is the focus of risk management. TOCDF is operating based on the *Risk Management Program Requirements* document (PMCD, 1996c). This risk management function includes environmental compliance and safety performance evaluation on a daily basis, emergency preparedness as a continuous readiness, and incident and accident investigation on a prompt, as-needed basis. Systemization and operations also manages changes to the facility and implements any lessons learned from other facilities or PMCD efforts. Overall, it is the goal of the operations function to develop, promote, and monitor a strong safety culture that ensures that appropriate concern for safety is ingrained in the thoughts and actions of all personnel associated with the operations.

3. *Safety.* Safety assesses the hazards and safety risks to the public and the CDF workers, meeting Army and OSHA requirements. The Risk Management and Quality Assurance (RM&QA) Office has been assigned

the role of integrating the risk management activities and generating Risk Management Program (RMP) requirements for operations and design and construction activities.

4. *Environmental Protection.* Environmental protection is provided by assessing the hazards to the environment and its populace and biota. The Environmental and Monitoring (E&M) Office has been assigned the role of preparing environmental impact statements for the CDFs, acquiring the permits for the facilities, and establishing procedures to track compliance with EPA requirements.

5. *Emergency Preparedness.* Emergency preparedness is provided by assessing potential emergency scenarios as well as their possible protective actions. CSEPP has been assigned the role of planning related to continued storage and the CDF sites, conducting exercises, and providing liaison with FEMA and local and state authorities.

6. *Public Outreach.* This function is provided by the Public Involvement and Outreach program. The Public Affairs Office (PAO) in PMCD provides the various liaison activities through the field offices that bring stakeholders—state authorities, local citizenry, and the Citizens' Advisory Commissions (CACs)—and the Army together in order to understand issues and concerns regarding safety, environmental protection, and emergency preparedness.

These functions are discussed further in the remainder of this guide. The format of figure 1 is used as the basis for some subsequent figures, as more specific information is discussed below.

3.2 Risk Management Activities

There are five primary activities of risk management. Table 1 shows that they vary according to the risk management functions. The activities are:

1. *Assessment* - identifying, evaluating, and understanding hazards and risks

2. *Requirements* - establishing criteria for safety, environmental protection, and emergency preparedness

3. *Monitoring* - the regular trending and tracking of performance

Table 1. Activities by Risk Management Function

Functions	Activities				
	Assessment	Requirements	Monitoring	Management of Change	Public Participation
Design & Construction	×	×		×	
Systemization & Operations	×	×	×	×	
Safety	×	×	×	×	
Environmental Protection	×	×	×	×	
Emergency Preparedness	×	×	×	×	
Public Outreach				×	×

4. *Management of Change* - the evaluation of strategic or necessary changes to the facility or its operation against the requirements of risk management. This includes an authorization process, the approval/acceptance chain of command needed to initiate change following its evaluation.

5. *Public Participation* - the communication of facility and operations risks and the manner in which the Army is managing those risks, the gathering of input and feedback from the public, and the use of that information in decision-making.

These activities are discussed in the next five sections as they relate to the risk management functions.

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SECTION 4
ASSESSMENT

As described in section 1, it is necessary to understand risk in order to effectively manage it. Table 1 indicates that assessment—identification, evaluation, and understanding—of risk is performed in some manner in all five of the technical risk management functions. A risk assessment, sometimes referred to as a risk analysis, is an engineering/scientific effort that is often sufficient to indicate needed actions or requirements in itself. If a new hazard or risk is identified prior to the construction of a CDF, then design and construction must accommodate it into design criteria. This has been typical in PMCD's efforts over many years. Safety assessments are performed to identify, evaluate, rank, or quantify risks to workers and the public. Environmental assessments are performed to ensure that the facility meets regulations and to gain additional understanding of potential health and environmental risks. Figure 2 illustrates how the assessments relate to the risk management functions.

4.1 Overview of Risk Assessments

System safety risk assessment (DA, 1990; PMCD, 1996a) and process safety management (OSHA, 1993) are defined for PMCD in the *PMCD System Safety Management Plan* (SSMP) (PMCD, 1996a). The first of the risk assessments performed under system safety are called HEs. HEs identify and rank the risks to the public and the facility workers from industrial and occupational hazards that exist because of the operation of the disposal process, including those unique to the CDF. HEs are performed at different stages of the facility's design and in differing degrees of comprehensiveness, including:

1. The preliminary hazards list (PHL) and analysis (PHA), early audits of as many elements of the facility as may be known at the time

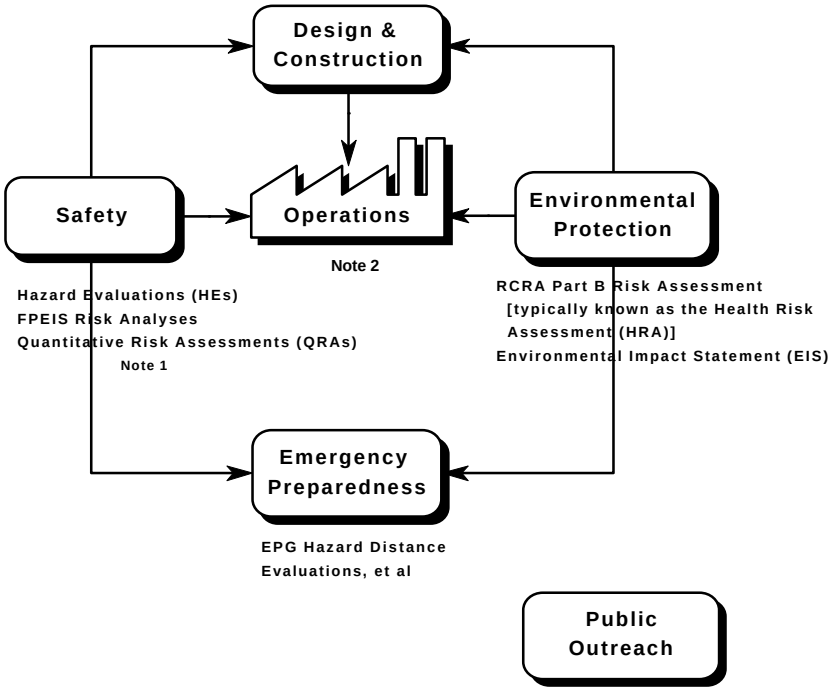


Figure 2. Assessments and the Functions of Risk Management

2. System hazard analysis (SHA), identifying hazards at the system level of resolution

3. Job hazard analysis (JHA), identifying the hazards to operators and other workers, and auditing the procedures for accommodating these hazards

4. Process hazard analysis, which identifies the hazards of the integrated facility and its processes at a mature stage of design.

The HEs allow the ranking of risks that may be used to identify strategies to manage the risks. In addition to meeting PMCD's risk management objectives, these HEs defined in the SSMP also meet all required Army regulations as well as hazard analyses required by OSHA and EPA.

The most extensive type of risk assessment is the QRA. QRAs are not required by system safety. However, the initial QRAs were performed by PMCD in support of the NEPA/EIS process (GA, 1987a-c). In 1994, the National Research Council (NRC) suggested (NRC, 1994) updating these studies with QRAs using more recent QRA technology (for example, USNRC, 1990; CCPS, 1989) as well as taking advantage of the latest information about the design and operation of the CDFs and information about their sites. The studies are being conducted in two phases. The Phase 1 QRAs are completed prior to facility construction and are limited to point estimates of public risk. The Phase 2 QRAs are based on the as-built plant design and operations, and include detailed assessments of public and worker risk. The Phase 2 assessments include detailed consideration of uncertainties. Risk insights from these studies have already been used by PMCD in modifying design and operational aspects of Tooele and the other CDFs.

Specific assessments are also conducted to support the understanding needed for risk management of environmental concerns. QRAs and HEs generate information useful for consideration of environmental risk since the potential for public risk is associated with offsite releases that, were they to occur, could have environmental effects. Thus, minimization of public risk has a direct and positive influence on environmental risk. In addition, certain environmental-related assessments are required by regulations. RCRA, Part B, requires the submittal of a risk assessment for each site relying on combustion technologies. This assessment includes an HHRA and an ERA. The RCRA Part B risk assessments follow implementation guidance published by the EPA. These assessments may use a screening methodology or may reflect site-specific demographics.

[The risk management policy and guidance provided here is designed for any technology. The RCRA Part B risk assessment is specifically associated with combustion technologies. Any alternative technologies might require an analogous assessment. This guide will be updated as needed to reflect changes in risk management activities.]

NEPA requires an EIS that addresses potential impacts on all aspects of the environment. While less quantitative than other assessments, the EIS process leads to understanding that is factored into risk management and decision-making.

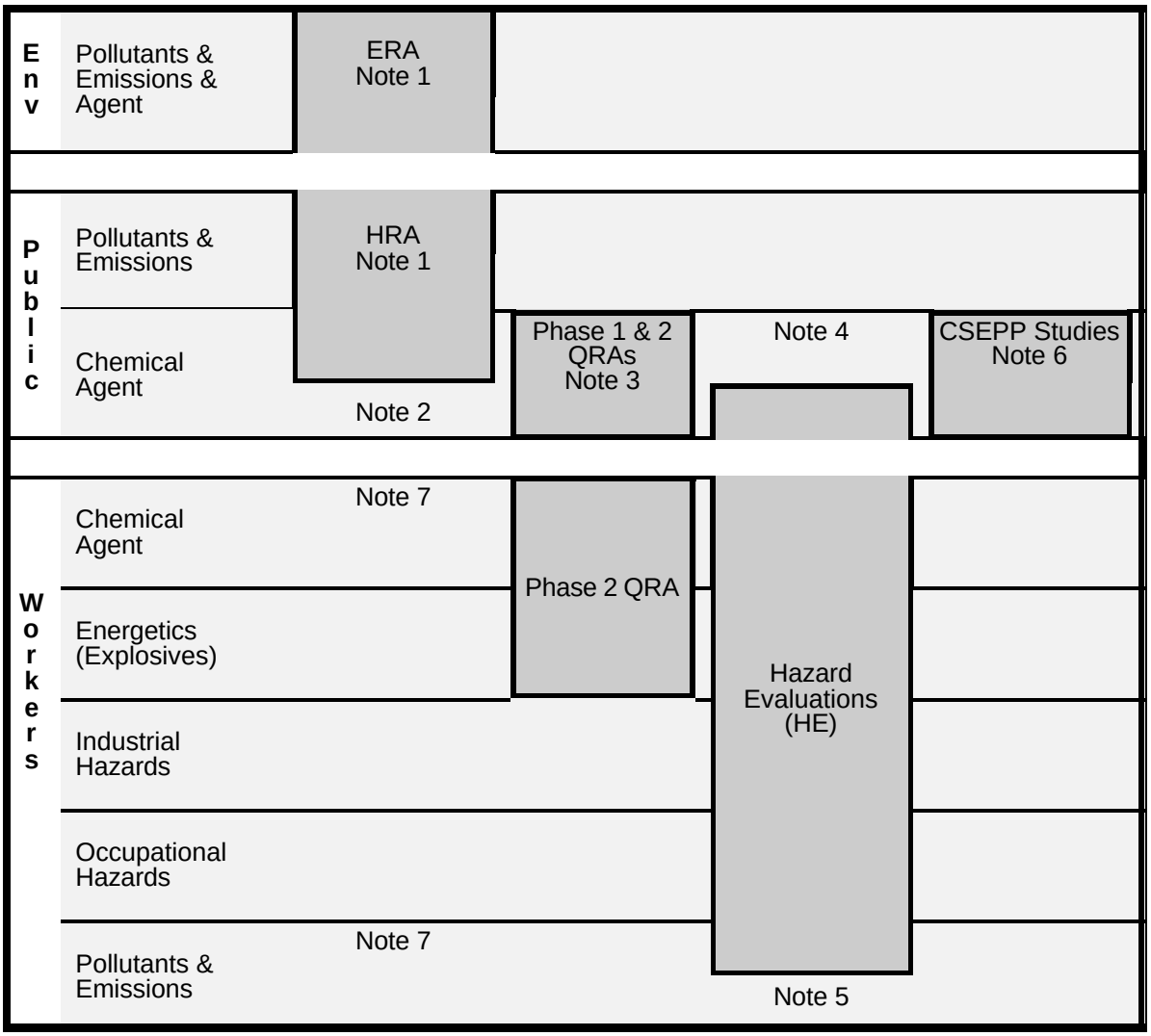
Another set of analyses is conducted to aid risk decision-making in a specific area—emergency management. Although not formal hazard and risk assessments, these studies use information from the QRA and the risk assessments supporting the FPEIS to facilitate offsite emergency preparedness. The analysis activities are directed by the Accident Planning Base Review Group (APBRG), which was formed to help develop understanding of risk in terms of how far from the site a hazard might affect the community. APBRG concluded that this type of risk understanding would best be controlled through the publication of site-specific emergency planning guides (EPGs), which describe potential risk and how to plan protective actions. The EPGs supersede the previous Emergency Response Concept Plans (ERCPs). Site-specific accident categories are developed in the EPG effort based on the distance to which the hazardous effects might extend. Thus, risk management decisions specific to emergency preparedness are based on assessment of potential accidents and their associated hazard distances as determined by the Army's air dispersion code, D2PC. Other codes are used to help determine strategies to respond to accidents (CSEPP APBRG, 1996). For example, the Oak Ridge Evacuation Modeling Systems (OREMS) code is used to estimate evacuation times following an accident and the speeds of automobile traffic during evacuation. The Protective Action Dose Reduction Estimator (PADRE) is used to estimate the dose reduction expected using alternative scenarios and protective actions. Because the basis for the EPGs is risk information, the risk assessments in support of the FPEIS were used until 1996. However, the site-specific QRAs will be used to update the EPGs as needed to reflect current understanding of risk. Although the QRAs determine risk, they are not focused on hazard distances and specific planning criteria. CSEPP uses accident information from the risk assessments and then establishes planning based on evaluation of D2PC results for different weather conditions.

4.2 Comparison of Risk Assessments

Further understanding of risk assessment activities may be gained through high-level comparisons of the studies. A full spectrum of hazards is assessed using the different assessments shown in figure 3. The figure indicates that PMCD pursues risk management through the understanding of public and worker risks from all sources.

The RCRA Part B risk assessment examines the risk associated with emissions from the incineration process. It includes the potential for off-normal releases, including releases of chemical agent from the stack, but it does not consider all possible accidental chemical agent emissions. The QRAs cover all potential releases of chemical agent, including the incineration processes, but also including any potential accidental releases (including spills, explosions, and fires) anywhere in the disposal process. Similarly, CSEPP performs evaluations of releases of chemical agent that could impact the public. CSEPP uses the QRA (and the former risk assessments of the FPEIS) as input, and analyzes data specifically focused toward their goals of emergency preparedness. The hazard evaluations required by the Army and PMCD, while more focused on worker risk, also include consideration of potential agent releases from the installation that could potentially affect the public. Therefore, as indicated in figure 3, the understanding of risk necessary to manage public risk is gained though a set of assessments that cover the range of possible risks. As noted previously, environmental risks are evaluated also, directly through the EIS and ERA portion of the RCRA Part B assessments, and indirectly through all activities associated with understanding public risk.

Worker risks are understood through a similar set of assessments. Due to the proximity to the processes, the workers have a larger set of potential hazards. The QRA examines chemical agent risk as well as any risk associated with the explosives in the munitions. Worker risks are considered comprehensively through the hazard evaluations. As indicated in figure 2, all worker hazards are subject to assessment,



Notes:

1. The RCRA Part B risk assessment contains both the human health risk assessment (HHRA) and the ecological risk assessment (ERA). The HHRA is commonly referred to as the health risk assessment (HRA).
2. The HRA only includes chemical agent for minor system upsets that result in small stack releases.
3. The risk assessments in support of the FPEIS had the same scope as the Phase 1 QRAs.
4. The hazard evaluations include consideration of the potential for agent release, but not to the extent that the QRA examines agent release.
5. The hazard evaluations include evaluation of equipment to limit the potential for release of pollutants, but do not include detailed assessment of worker health effects like the HRA.
6. CSEPP does not reassess public risk, but uses QRA information to do studies specifically aimed at improving emergency response.
7. The HRA does include a limited evaluation of risk to workers through the calculation of the acute health effects index.

Figure 3. Risk Assessment Coverage of Hazards

except that the study of the effects of chemical agent, pollutants, and emissions in the HRA is limited to the calculation of an acute hazard index for workers.

Chemical agent is the primary focus of safety risk assessments, although other chemical hazards are discussed in system safety analyses of various kinds. The focus of environmental risk assessments is broader in terms of hazards, including pollutants such as dioxins, furans, and heavy metals. The HRA examines only the stack releases but includes normal operation with or without agent disposal. Note that the environmental risk assessment focuses on normal and some off-normal facility conditions. The QRA examines solely accidental conditions and accidents solely as they involve agent and energetics.

Table 2 compares the two most comprehensive assessments to each other. The HRA is broader in its objectives but more conservatively analyzed. QRA models to greater depth but has no regulatory thresholds against which to compare its results. Because objectives, methods, focus, and result types differ for the two risk assessments, the results, although similar in concept, are not readily compared.

Figure 4 illustrates the timing of risk assessment activities. The HRAs are completed before facility startup for each incineration site and are updated after initiation of operation based on actual facility performance. The site-specific environmental impact statements are also completed during the approval process prior to facility construction. The EISs draw on information developed in the 1987 FPEIS risk assessments, and more recently from the site-specific QRAs, depending on the availability of the QRA relative to the EIS development process. Therefore some EISs have direct inclusion of QRA-generated information while others are based on the FPEIS assessments. The EIS and HRA are regulatory requirements; PMCD requires the other assessments. The QRAs are completed prior to facility operation. The Phase 1 QRAs are completed before facility construction (except in the case of Tooele, for which a Phase 2 QRA was initiated directly). The Phase 2 QRAs are completed for each site before facility

startup. After facility startup, the QRA must be maintained according to the site-specific risk

Table 2. Comparison of HRA and QRA

Element	HRA	QRA
Objectives	To assess whether a facility's health risk is below an acceptable threshold (a level for which further reduction would result in no practical consequence) for all emissions and pollutants during normal and some off-normal conditions	To assess relative risk contributors and safety risk from a facility due to agent release during accidents only
Methods	Conservative or otherwise USEPA-accepted methods, typically non-probabilistic	Generally best-estimate, probabilistic methods
Focus	Health and carcinogenic consequences of normal operating conditions	Lethal health and carcinogenic consequences and likelihood of accident scenarios
Types of Results	Excess upper-bound probability of cancer for carcinogens; hazard quotient (HQ), which is the ratio of assessed intake to toxicity value, for non-carcinogens; HQs are summed to a hazard index for substances that exhibit common systemic health effects	Cumulative distribution functions and expected values of acute fatalities and cases of cancer on an individual and population basis, with probabilistic estimates of uncertainty (in Phase 2); component and human risk contributors to absolute risk; scenarios for risk management and emergency planning

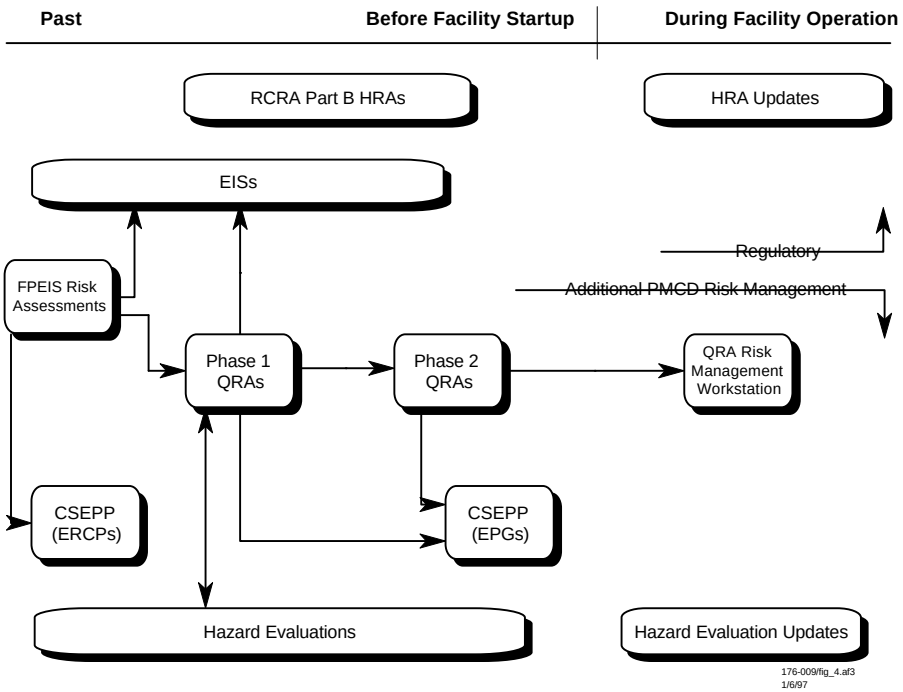


Figure 4. Timing of Risk Assessment Activities

management program. QRA computer workstations are developed to ensure use of the QRA models throughout the facility lifetime.

The hazard evaluations required by federal, PMCD, and Army regulations are also a life cycle effort. They are initiated during the facility design phase and are updated throughout facility operation. Updates can be required based on changes to facility design or operations, or new information concerning hazards and their effects.

Finally, the CSEPP risk assessment activities are also completed in phases. The CSEPP activities are not driven by the schedule for the disposal process. In the past, ERCPs were developed to assist in the emergency preparedness functions. As QRA information becomes available, the EPGs will embody the latest information and form a planning basis for potential risks associated with the stored stockpile of the disposal facility.

It is the primary purpose of risk assessment in risk management to inform decision-makers of risks and their relative importance, and to help identify ways in which to manage these risks. The implementation of this risk understanding is discussed in sections 5 through 9.

4.3 Risk Assessment Fact Sheets

The risk assessment activities just described are best understood through a review of their objectives, scopes, and methods. Synopses of the risk-related assessment activities listed in figure 2 are provided as fact sheets in tables 3 through 8. These tables provide a summary of assessment activities and reference sources for additional information. They also describe how the results are used in different risk management functions.

Table 3. Fact Sheet: Hazard Evaluations

Objective	Develop understanding of potential hazards as part of system safety evaluation of risk
Impetus	Department of Defense (DoD) and Army system safety requirements, and OSHA 1910.119
Strategy/ Schedule	Site-specific assessments before agent operations; maintained current
Scope	• Assessments of potential risk to workers (injury or death), system loss, onpost release, and offsite release • Focus on agent and explosives, some coverage of industrial and occupational hazards • Limited to CDF disposal operations (storage-related activities not within PMCD purview)
Methods/ Models	Standard system safety methods as specified in R 385-1 (PMCD, 1996d), R 385-2 (PMCD, 1996a), OSHA 1910.119, and CDF RMP Requirements (PMCD, 1996c) • Preliminary Hazard List • Preliminary Hazard Analysis • System Hazard Analysis • Jobs Hazards Analysis • Process Hazards Analysis
Results	• Determination of risk assessment codes (RACs) as specified in PMCD R 385-2 • Insights concerning important hazards and operations
Use of Results	Safety: direct input to risk management through RACs Systemization and Operations: safety improvements to designs and processes Environmental: understanding of potentially hazardous releases Emergency Preparedness: hazard information used to develop onsite emergency planning Public Outreach: assurance to public of comprehensive hazard assessment
Updates	To be maintained, updated, and used for risk management input throughout facility lifetime. This is achieved through the hazard tracking log (HTL).

Table 4. Fact Sheet: RCRA Part B Risk Assessments, Including the Human Health Risk Assessment and the Ecological Risk Assessment

Objective	Assure that emissions from the disposal facility do not adversely affect human health or the environment
Impetus	EPA requirement under RCRA, part B
Strategy/ Schedule	Site-specific assessments before agent operations (initial assessments are performed prior to construction)
Scope	• Emissions from incineration processes • Includes consideration of off-normal emissions (10 times the normal level for 20 percent of the time) • Covers all incineration processes on the site
Methods/ Models	EPA Implementation Guidance (USEPA, 1994) and protocol established through PMCD (USACDRA, 1995)
Results	• Conservative assessment of carcinogenic and noncarcinogenic risk for potentially exposed individuals • Risk is compared to a pre-established value of acceptable risk • Evaluation of impact on ecological risk, including water quality, sensitive habitats, or endangered species • Assessment of agricultural impact
Use of Results	Safety: potential insights concerning risk contributors Systemization and Operations: understanding of incineration operations most critical to health and ecological risk Environmental: necessary input to RCRA permit application Emergency Preparedness: not applicable Public Outreach: assurance of comprehensive risk assessment and meeting of state acceptance criteria
Updates	To be updated based on results of trial burns and any major changes to incineration processes

Table 5. Fact Sheet: Risk Assessment in Support of the FPEIS

Objective	Determine the probability and consequences of accidental agent releases
Impetus	Needed for risk-based decision-making concerning disposal alternatives
Strategy/ Schedule	Completed in 1987, updated to address some specific issues in the interim
Scope	• Accidental releases of chemical agent, all causes, including external events such as earthquakes • Comparative assessment of 25 years of continued storage, onsite disposal, regional disposal, national disposal, and partial relocation • Based on early (35 percent) design of disposal processes • Limited to public risk but includes estimate of plume area
Methods/ Models	Standard quantitative or probabilistic risk assessment methods
Results	• Quantitative assessment of risk, probability, and consequences of the different alternatives • Identification of possible mitigation to reduce some of the risks
Use of Results	Safety: used as basis for risk decision-making Systemization and Operations: identification of potential improvements, risk mitigation options Environmental: input to the FPEIS and the site-specific EISs before site-specific QRAs were available Emergency Preparedness: detailed listing of scenarios for accident planning base (to be replaced by the Phase 1 QRAs) Public Outreach: basis source of risk information, especially concerning options
Updates	Has been updated to address specific issues, but onsite disposal and storage risk analysis updates currently being performed (QRAs) will be used in future risk management in lieu of this assessment.

Table 6. Fact Sheet: Quantitative Risk Assessment

Objective	Determine the probability and consequences of accidental agent releases
Impetus	NRC recommendation
Strategy/ Schedule	Phase 1 QRAs for all CONUS sites (except Newport and Aberdeen) to be completed in FY 1996; Phase 2 QRAs for all CONUS sites by CDF startup
Scope	• Accidental releases of chemical agent, all causes, including external events such as earthquakes • Entire disposal process from handling at the igloo to final disposal of all agent and explosives • Assessment of risk of stockpile storage, both extended storage and storage during the disposal process • Phase 1 QRA limited to point estimate of public risk and update of FPEIS • Phase 2 QRA includes all site-specific aspects, public risk, worker risk, and evaluation of uncertainty
Methods/ Models	Standard QRA methods adapted from NUREG-1150 for this process (SAIC, 1996; SAIC, 1997) (Also see appendix C)
Results	• Quantitative assessment of risk, probability, and consequences of accidents • Ranking of important plant and operational features • *Risk Management Program Requirements* and site-specific risk models • Emergency response planning scenarios
Use of Results	Safety: direct input to risk management Systemization and Operations: feedback to operations, assessment of special issues, evaluation of modifications, day-to-day management of risk Environmental: input for the EIS when schedule allows Emergency Preparedness: detailed listing of scenarios for accident planning base and EPGs Public Outreach: input useful for discussion of risk with the community
Updates	To be maintained, updated, and used for risk management input throughout CDF lifetime. This is achieved through the risk management workstation and HTL.

Table 7. Fact Sheet: Environmental Impact Statement

Objective	Summarize potential environmental effects of facility construction and operations
Impetus	NEPA (PL 91-190)
Strategy/ Schedule	Two-tier approach: programmatic and site-specific • FPEIS completed in 1988 (PMCD, 1988) • Site-specific EIS conducted in two phases Phase I: environmental report based on update of FPEIS Phase II: site-specific EIS Some site EISs complete, others in progress
Scope	• Impact of construction and operation of a CDF • Decommissioning/dismantling to be considered in later NEPA documentation • Comprehensive environmental impact, including: 1) human health, 2) air quality and noise, 3) land and water use, 4) ecology, 5) waste management, 6) socioeconomics, and 7) cultural resources
Methods/ Models	Compliance with Council for Environmental Quality regulations implementing NEPA (40CFR, 1500-08) and Army Regulation 200-2
Results	• Description of existing environment • Description of potential impacts in each of the areas itemized under scope
Use of Results	Safety: input to risk decision-making in terms of potential impacts Systemization and Operations: establishes baseline impact of construction and design Environmental: satisfies NEPA requirement Emergency Preparedness: not applicable Public Outreach: assurance of comprehensive assessment of environmental impacts
Updates	Only updated for a major change in the disposal process or a significant change that affects the environment.

Table 8. Fact Sheet: Emergency Planning Guide Hazard Distance Analyses

Objective	Provide state and local authorities with a consistent basis for emergency planning
Impetus	Accident Planning Base Review Group
Strategy/ Schedule	Drafts completed for all sites, they will be updated if new information arises; the following studies are underway: demographic surveys, evacuation time estimates, and site-specific meteorological conditions
Scope	• Same as FPEIS Risk Analysis or QRA • Accidental releases of chemical agent
Methods/ Models	• Use FPEIS or QRA input concerning accidents • Perform downwind hazard distance calculations with D2PC (see appendix C) • Estimate evacuation time and traffic speeds with OREMS • Estimate expected dose reduction of alternative scenarios and protection actions with PADRE
Results	Accident categories based on potential hazard distances
Use of Results	Safety: n/a Systemization and Operations: n/a Environmental: n/a Emergency Preparedness: used by CSEPP for planning and communication, used by sites to help establish emergency planning Public Outreach: additional source of risk information that is familiar to local communities
Updates	Updated to reflect changes in identified accidents or releases after completion of Phase 1 QRAs.

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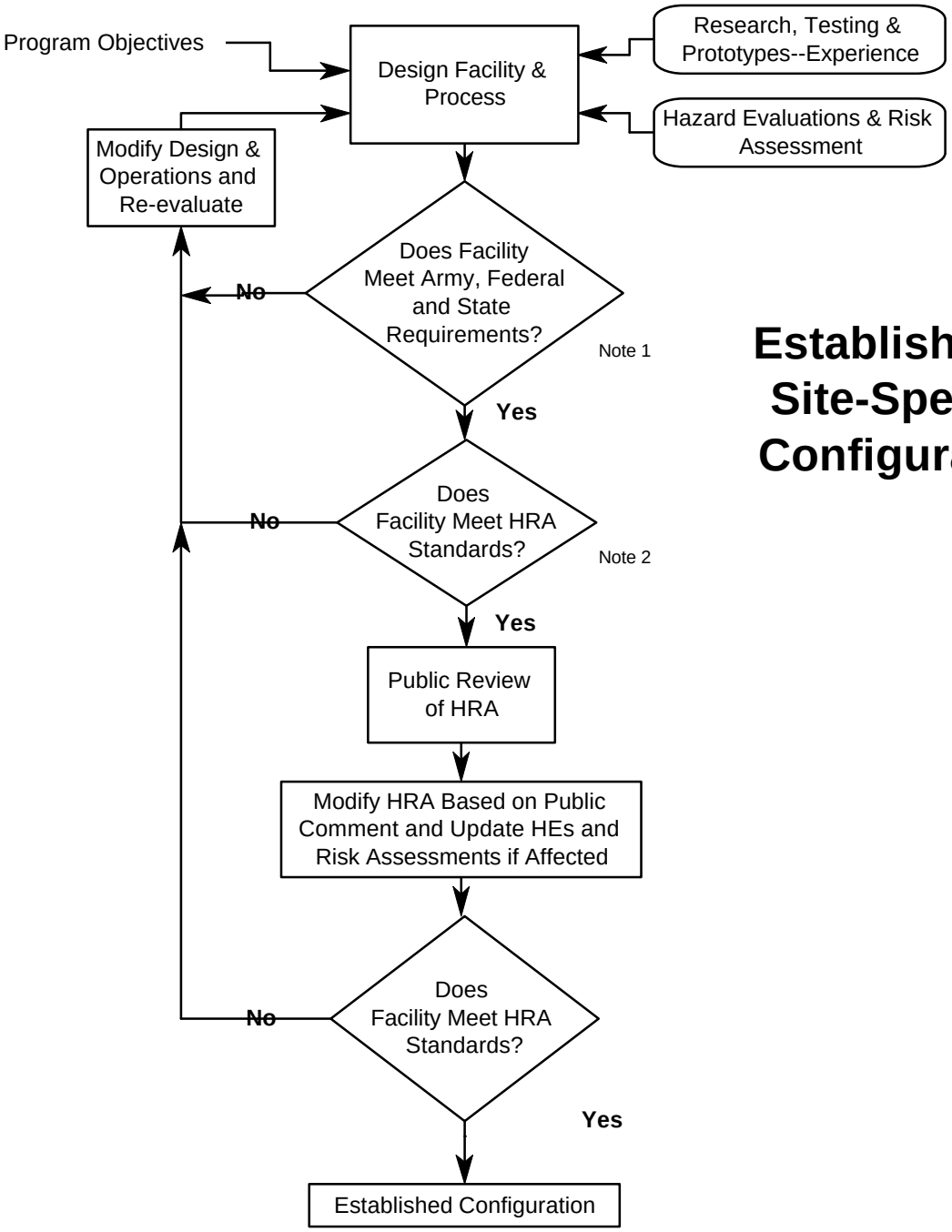
SECTION 5
REQUIREMENTS

Hazards exist in the CSDP by mission: to destroy a hazardous material, often integrated into an explosive munition. Hence, the disposal process has inherent risks that can be managed but not entirely eliminated (Perrow, 1984). PMCD has established mechanisms to manage risk through decision-making based on an understanding of potential risks and the effectiveness of preventive or mitigative factors. Risk assessment, as described in the previous section, is a basis for developing design criteria and operational requirements. Safety, environmental, and emergency preparedness requirements have evolved over the whole CSDP/PMCD effort, often directed by Army regulation, for example, the requirements for system safety; or by federal or state law or regulation, for example, the permitting criteria from the EPA. The process of controlling risk includes the establishment of requirements to ensure that the risk is controlled. This section describes the role of risk-oriented requirements during the initial establishment of the design and operations and throughout the facility life cycle.

5.1 Establishing a Site-Specific Configuration

The risk management function starts with the initial design of the disposal facility and associated processes. PMCD establishes a facility/process configuration for each site that accomplishes the program mission of disposing of the chemical agent and weapons at a site, and also meets all PMCD objectives relative to that mission with minimal risk to the public, workers, and environment, taking into account site-specific risk factors. Figure 5 illustrates the process for establishing a site-specific configuration. The operational objectives are determined by the stockpile to be destroyed at the site (that is, the types of munitions and agents). A facility is designed to meet these objectives based on the research, testing, and prototype experience that PMCD has developed. To the greatest extent possible, design continuity is maintained



1. This internal review includes consideration of Army safety criteria during the design phase.
2. HRA is for incineration processes. There may be analogous assessments for alternative technologies.

Figure 5. Process for Establishing a Site-Specific Configuration

from site to site to maximize the benefit of operational experience and insights from the Chemical Agent Munitions Disposal System (CAMDS), JACADS, TOCDF, and subsequent facilities.

As indicated in figure 5, the process of HE also starts during the design phase. HEs described in section 4 are initiated as the design develops, and risk reduction measures are fed back into the design of the facility and operations. In an iterative fashion, a design is developed that is then tested against the various risk-related requirements. Criteria that cannot be met require changes to establish a facility that will meet all requirements. The requirements in the design stage include:

- Army requirements for safety, especially explosive and chemical agent safety
- Federal requirements, including those of OSHA and EPA
- Local requirements, such as building codes
- Other requirements, such as design codes for furnaces, electrical equipment, etc.

In all cases, risks not specifically covered by regulatory criteria are minimized to the greatest extent possible.

As shown in figure 5, the next step is an assurance that the facility will meet the risk-related standards associated with the RCRA Part B HRA. Standards have been proposed by the EPA, but each state establishes its own standards for the HRA. The HRA standards are selected by the states to ensure that the risks of emissions pose no practical consequence to the surrounding population. This may be accomplished with a screening assessment or a more detailed site-specific assessment. The facility must meet these standards or be modified and re-evaluated. The permit process also

includes a public review of the RCRA Part B risk assessment. Responses are provided to public comments and changes are made to the HRA if indicated by the input from the public review process. If changes to the HRA were required, the facility must be re-evaluated and must meet the HRA standards in order to establish a site-specific configuration. At that point the facility and operations may be implemented. During this process, the HEs and other (non-HRA) risk assessments are also updated to ensure that they reflect the latest plant design.

Although shown sequentially in figure 5, many of the activities indicated will be performed in parallel. However, the basic process described must be fulfilled in order to establish a site-specific configuration. Once established, the process must be operated safely, as described below, and monitored as described in section 6. Any changes to the facility or its operations must be carefully managed, as described in section 7.

5.2 Operating a Safe Facility

In order to ensure that the facility and its operations meet PMCD's risk management objectives, a set of risk-related requirements has been developed. It is not the purpose of this document to delineate these requirements; the *Risk Management Program Requirements* document (PMCD, 1996c) lists all the requirements. That document also references the source of the requirements, be they Army, federal, or PMCD. There are over 100 very specific requirements on all aspects important to risk management, organized by the following activities:

- Risk assessment
- Establishing safe management and operations
- Management of change at the facility
- Performance evaluation
- Incident investigation
- Emergency preparedness

- Risk management plan compliance.

The CDFs are responsible for implementing the requirements. These requirements form the basis for risk control and decision-making and establish continuous reevaluation of facility safety and environmental compliance.

While the requirements for risk management are important, it is equally important that the operations at the facility are carried out under a strong safety culture. A safety culture is the assembly of characteristics and attitudes of the organization and the individuals in that organization that establish, as an overriding priority, that plant safety issues receive the attention warranted by their significance. PMCD has made it incumbent on the operating contractors that safety culture be developed and monitored.

5.3 Risk Authorization

Risk management ultimately involves informed decisions relative to risks and the authority to act accordingly. Any environmental risk that does not comply with the CDF's environmental permit must be rejected, or authorization must be obtained to modify the permit so as to accept the risk. Environmental risk authorization is based on comparison to pre-established acceptance criteria. For example, if a risk is assessed to be above a prescribed level according to the HRA state standards, then the process cannot be permitted without approved efforts to reduce the risk. This risk is further managed through monitoring activities for any pollutants that could have environmental effects. Stringent criteria establish limits on any potential releases. Environmental risk associated with chemical agent is further managed as a byproduct of the activities described in section 4.2 to manage risk through the prevention of releases.

Any evaluated safety risk must be one of the following:

a. Accepted as sufficiently low to continue to operate

b. Accepted as high but signed off by a formal waiver as a necessary risk

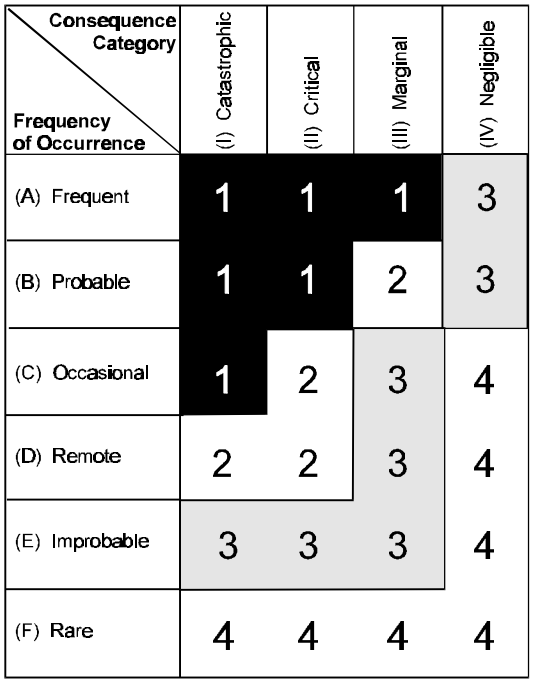
c. Unaccepted but returned for re-evaluation to seek further cost-effective control

d. Rejected and the process involving the risk not pursued.

System safety risk authorization is implemented by means of the RAC authority matrix (PMCD, 1996a) shown in figure 6. Simply put, a hazard or hazardous condition (that is, a potential risk) is assessed as to its likelihood (that is, frequency) in six relative categories. Then, the severity of the possible consequences from the hazard is assessed and classified among four categories: worker risk, equipment damage, onpost release potential, and offsite release potential. The matrix then identifies a RAC for this pair of assessments.

For example, a hazard with a frequency that is assessed to be remote (category D) and a severity that may be critical (category II) is a IID hazard and, according to the fourth row and second column of the matrix, is a RAC 2 hazard. The authority matrix then specifies that PMCD is the decision authority for this hazard. That is, the Program Manager (PM) will accept the risk by waiver (RAC 2 is normally considered too high a risk level to accept) or return the “problem” to PMCD/PMCSD staff to identify further risk controls through any of the strategies described previously. By policy, only RAC 3 and 4 hazards are accepted in the CSDP.

The SSMP also lists criteria for acceptance of QRA-derived risk results. Individual risk contributors are translated into RACs and assessed accordingly. Overall risk is also monitored to ensure that it does not increase substantially from the baseline risk.



RAC	Authority Level	Decision Maker
IA, IB, IC, IIA, IIB, IIIA	1	ASA, Research Development & Acquisition
ID, IIC, IID, IIIB	2	PM Chemical Demilitarization
IE, IIE, IIIC, IIID, IIIE, IVA, IVB	3	PM Chemical Stockpile Disposal *
IF, IIF, IIIF, IVC, IVC, IVE, IVF	4	Site Safety Manager

** may be delegated to Site Project Manager*

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Figure 6. Risk Authority Matrix

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SECTION 6
MONITORING

Accident prevention is a proactive effort to avoid (that is, prevent) accidents. The activities of evaluating hazards and promoting safe and environmentally sound practices (OSHA, 1993; USEPA, 1996) help establish a facility with an acceptable level of risk. In this way accidents are avoided to the maximum extent that is reasonably possible. These activities are now described.

6.1 Performance Evaluation

Given that not all hazards can be removed nor all accidents avoided, other controls are implemented. These are directed either toward risk reduction—the active attempt to reduce the likelihood of accidents, or toward risk mitigation—the active attempt to reduce the possible severity of the consequences of accidents. Risk reduction and mitigation are accomplished through design and operations, primarily by means of operational requirements, for example, limits and conditions of operation (LCOs), that can be objectively monitored on a daily or short-term basis in order to evaluate the success of risk management.

Feedback from actual systemization and operations provides data on operations, equipment performance, incidents, and precursors to incidents (near-misses). Performance data that indicate unanticipated levels of risk are subject to further consideration in the risk decision-making framework developed to evaluate and authorize changes to the facility or its operations. Safety culture is monitored as a key indicator of operations safety. Each CDF's environmental permit contains requirements for environmental compliance, and the CDF implementation plan for the *Risk Management Program Requirements* contains the safety requirements for monitoring.

In the extreme of deviation, the full complement of the Army's incident and accident investigation process (PMCD, 1996b) is invoked to identify changes due to such events.

6.2 Planning Exercises

Emergency preparedness is pursued to plan for credible contingencies, with resources focused first on the higher risk possibilities and the most effective preparedness strategies. Emergency preparedness includes both onsite and offsite contingencies. It offers an independent level of protection in case all of the other risk management strategies fail to prevent a possible threat.

As described in section 1, CSEPP has responsibility for enhancing offsite response to chemical agent emergencies (DA, 1994a, b). While the Army has primary responsibility on installations where these agents are stored, neighboring local jurisdictions have primary responsibility for offpost releases. The strategy behind CSEPP is to develop an effective response capability through: 1) enhancing emergency preparedness in offpost jurisdictions, 2) improving existing capabilities of state agencies upon which local jurisdictions depend, and 3) facilitating emergency preparedness through financial and technical knowledge possessed by the Army and other federal agencies. The maintenance of preparedness is monitored, for example, by means of periodic exercises at the depots.

6.3 Risk Tracking

Hazards and risks related to safety, environmental protection, or emergency preparedness are not just tabulated and shelved; they are tracked and updated. This activity forms a crucial basis of PMCD risk awareness. All identified risks are documented in their assessments. But because the disposal processes may mature, risk modeling techniques may improve, or more data may become more available, assessed risks can change over time and must be revisited periodically to keep an

up-to-date profile of the risks at a CDF. For example, the system safety HTL (PMCD, 1996a) is one of the ways in which risks and hazards are tracked formally throughout the program and at each site.

6.4 Lessons Learned

Two key activities to manage performance-based risk are the PMCSD lessons learned programs: the Design Lessons Learned (DLL) program and the Programmatic Lessons Learned (PLL) program. As the name implies, the DLL program focuses on capturing improvements in equipment design and configuration, including computer software. The PLL captures all other non-design lessons learned, such as those from systemization or operations, but also includes potential considerations of management policies and emergency response. The lessons learned programs remain an element of risk management because many of the improvements identified through risk evaluation activities are then transmitted to the DLL and PLL programs for consideration at other sites. Thus, the lessons learned programs provide a vehicle for necessary integration to ensure that performance feedback is shared among all sites.

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SECTION 7
MANAGEMENT OF CHANGE

Once an established site-specific configuration exists (see section 5.1 and figure 5), changes to that configuration may be proposed. Changes can be inspired by the following:

- Performance that fails to comply with the permit or safety requirements
- PLL/DLL insights/recommendations
- Newly identified hazards that require disposition and tracking
- QRA-recommended actions
- Operational needs
- Cost reduction or efficiency initiatives
- Safety enhancements.

Changes may be initiated at one facility or programmatically. All changes will be implemented based on the evaluation and authorization process described in this section.

7.1 The Change Process

Figure 7 illustrates the overall change process. As noted above, change may be suggested by any number of insights. This conceptual need for change is then made into a specific proposal for change or a package of related changes necessary to accomplish the improvement objective. Once defined, it is necessary to determine if the change requires an augmented risk review or if it may be handled through the standard technical configuration management activities, as described in section 7.2. (It is noted that the latter activities also include a review of the risk impacts of the change.)

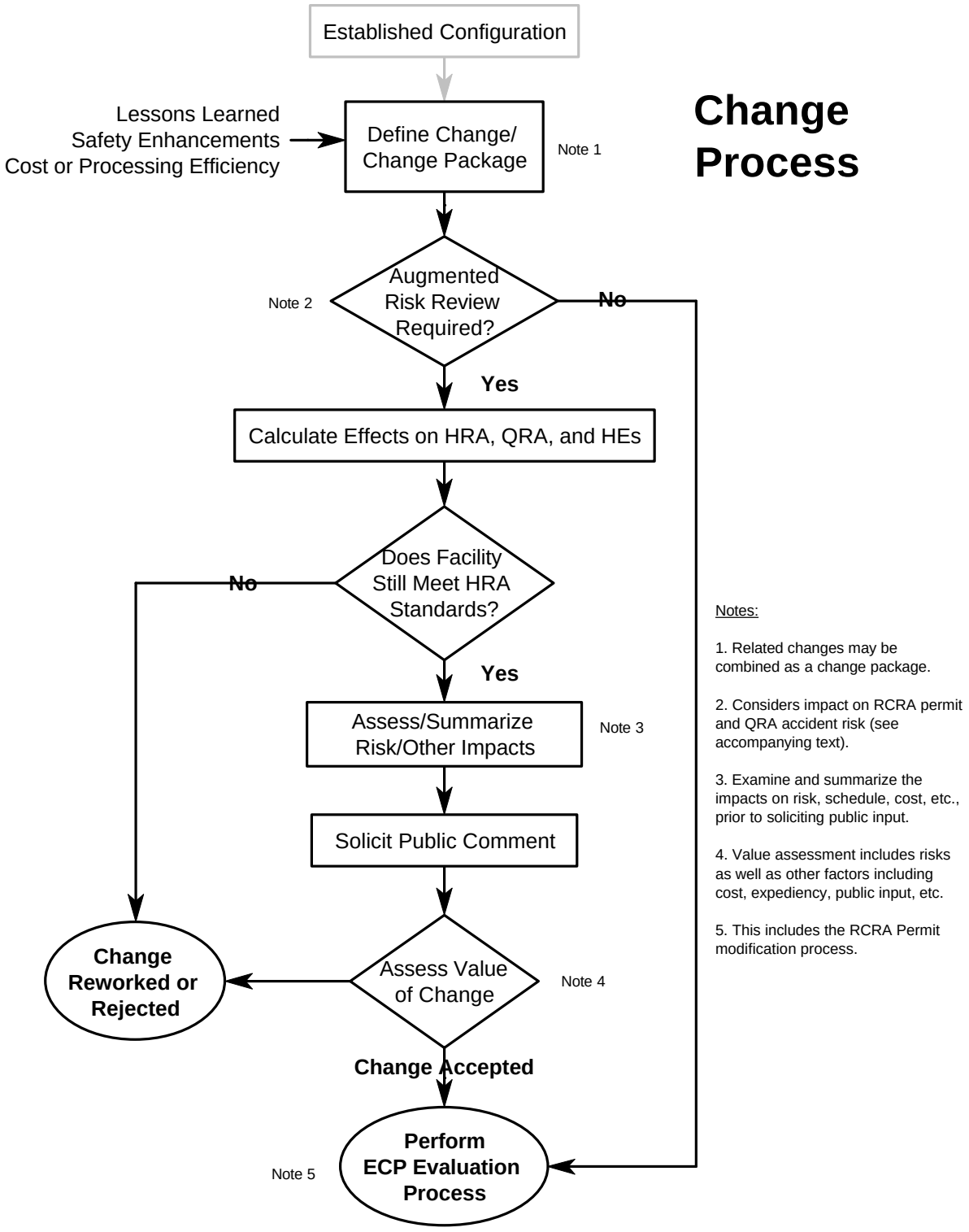


Figure 7. The Change Process

The augmented review is intended for changes that are recognized up front as having the potential to result in changes to risk. This is discussed in detail in the following paragraphs.

7.1.1 Is an Augmented Risk Review Required? The intent of the augmented risk review portion of the change process is to ensure appropriate PMCD treatment and public participation in decision-making for changes that could affect risk. The EPA has, as part of its permitting process, already categorized modifications as Class 1, 2, or 3 (40 CFR, Ch I, 270.42). Class 1 modifications are relatively minor changes that do not significantly impact the operation of the facility. Examples include correction of typographical errors in the permit or replacement of equipment (for example, valves) with functionally equivalent components. Class 2 and 3 modifications could have more significant impacts on facility operation. Specific criteria and examples are provided in 40 CFR 1.270.42 and included as appendix D. Making use of these already established definitions, an augmented risk review will be performed for changes that are:

1. Defined as Class 2 or Class 3 RCRA permit modifications

   AND

2. Are assessed as either:

   a) Requiring an update of the HRA

      OR

   b) Having a potential impact on the QRA.

If a change is identified in this step as *not* requiring an augmented risk review, then the change enters the standard Engineering Change Proposal (ECP) process described in section 7.2. That process includes a subsequent evaluation of the risk impacts of the change, so that any Class 1 modifications that turn out to have HRA or QRA risk implications are then addressed through the augmented process. (A review of Class 1 modifications failed to reveal any such cases, but the process includes this step to ensure that risk impacts are fully evaluated.) The intent here is to identify, early in the process, changes that could affect the risk associated with the facility. In this way, the risk impacts can be evaluated and presented to the public for their input prior to the decision on whether to proceed with the change.

7.1.2 Calculate Effects on HRA, QRA, and HEs. For a change that requires an augmented risk review, the effects of the change on the risk measures in the HRA, the QRA, and any other applicable HEs are quantified. The latest versions of the methodologies used to perform the assessments and evaluations for the established configuration are used to determine the impact of the change (see section 4 for a discussion of the various assessments).

7.1.3 Does Facility Still Meet HRA Standards? As indicated in figure 7, a change will not be approved for further consideration if it fails to meet the HRA standards established by the states. The standards are part of the permit, and modifications cannot be proposed that would cause the facility to be out of compliance. The change may be reworked to accomplish the same objective and re-evaluated until it meets the HRA standards. These standards are established to ensure that the emission levels pose no public health risk of practical consequence. The EPA has noted that “science can describe the conditions under which risks are so low that they are generally considered to be of no practical consequence” (USEPA, 1991). The EPA has also stated that excess lifetime cancer risk at or below the 10^{-5} level for combustion facilities, on which the state criteria are generally based, will “ensure protection of human health from emissions of carcinogenic constituents” (USEPA, 1994). It should be noted that meeting the HRA criteria does not mean that the change will be implemented. It means

only that the change process will proceed, and the value of the change will be assessed.

7.1.4 Assess and Summarize Risk and Other Impacts. Once the effects of the change on the HRA, the QRA, and any other applicable HEs are quantified and the change is found to meet the HRA standards, the Army will begin preparation for going to the public to solicit their input. To ensure that both the Army and the public will have all of the relevant information concerning the impacts of the proposed change, other areas will also be examined, and the impact of the change on these areas will be estimated. Including risk, the areas to be considered can be broken into four groups:

1. Public risk
2. Worker risk
3. Cost
4. Implementation schedule.

Public risk will be examined in terms of changes to the QRA-assessed risk of the existing facility. The QRA includes many different risk values and insights. The change in risk will be focused on the key risk measures included in the QRA:

- Societal average fatality risk (expected fatalities) for total risk—the sum of the risk of disposal processing and the risk of storage during the entire disposal period

- Societal average fatality risk (expected fatalities) for the disposal process alone

- Individual (per-person) fatality risk for the members of the public living closest to the site.

The decision-making process will also examine other QRA risk factors that are affected by the change. For example, the change could affect the probability of "large" (but infrequent) consequences, for example, the consequences at one-in-a-billion probability. Also, although the cancer risk associated with accidental releases has been assessed as very low, changes in that risk measure would also be considered.

Agent-related worker risk is assessed quantitatively in the Phase 2 QRAs. Impact on worker risk will also be examined if the corresponding Phase 2 QRA has been completed. In addition, the hazard evaluation process includes an assessment of the potential impact on workers, including non-agent risks. Insights regarding the potential for the change to significantly affect the workers' exposure to hazards will also be recognized.

Cost and schedule impacts associated with the proposed change will be determined, including the implications of changes in schedule relative to public law, treaties, or storage risk.

The impact of the change in each of the areas discussed above will be identified and summarized in a format suitable for public review. The Army will also include an explanation of its preliminary assessment of the value of the change. That is, based on the impact of the change on the four areas above, an initial recommendation will be provided to the public for their comment. This initial recommendation will not be a rigid indication of the Army's position on the change. Rather, it will be an informal statement of the Army's current take on the value of the change, and it will serve as a starting point for the public to aid in their understanding of the issue.

7.1.5 Solicit Public Comment. Once the impacts of the change on risk and other factors have been identified and summarized as described in section 7.1.4, the Army will make this information available to the public. This review will provide a public voice in risk management processes, such as assessment of risk tradeoffs or insights gained

from sensitivity studies. The extent of the review process will reflect the RCRA classification of the change as described below.

Changes requiring Class 2 modifications:

- The Army provides a synopsis of the preliminary analysis results to the state regulators and the CAC with a notification that it intends to solicit public comment.

- The synopsis is offered for local public review through normal outreach channels such as media announcements, outreach office handouts, mailings, etc.

- The Army will formally brief the CAC, if it so requests.

- A 3-week public comment period will follow the notifications. Comments will be submitted through the CAC and forwarded to the Army.

- The Army will prepare responses to all public comments, brief the regulators and CAC on results and planned disposition of the comments and whether it intends to pursue a permit modification, and issue a final assessment summary. The value assessment process used to reach a decision on whether to proceed with the change is described in the next section. If implementation is to be pursued, the Army will submit a RCRA permit modification request.

Changes requiring Class 3 modifications:

- The Army provides a synopsis of the preliminary analysis results to the state regulators and the CAC with a notification that it intends to solicit public comment.

- The synopsis is offered for local public review through normal outreach channels such as media announcements, outreach office handouts, mailings, etc.

- The Army will formally brief the regulators and the CAC on the proposed change.

- The Army will conduct a public workshop to provide detailed information on the proposed change. The workshop will be announced through local media.

- A 3-week public comment period will follow the workshop. Comments will be submitted through the CAC and forwarded to the Army.

- The Army will prepare responses to all public comments, brief the regulators and CAC on results and planned disposition of the comments and whether it intends to pursue a permit modification, and issue a final assessment summary. The value assessment process used to reach a decision on whether to proceed with the change is described in the next section. If implementation is to be pursued, the Army will submit a RCRA permit modification request.

The goal of this step, the solicitation of public comment, will be active involvement of the public in the change process at each site. In all cases, public input will be an important consideration in the decision-making process.

7.1.6 Assess Value of Change. Once the public has had time to review the impacts of the change and to provide comments, the Army will complete the process of assessing the value of the change. Value is not assessed according to a formula. It is based on a structured process that involves the consideration of many competing factors, including risk and public input. This process is now described.

Using the information generated as part of the augmented risk review and the public input described in section 7.1.5, the Army will consider the change in the context of the factors listed in table 9.

Table 9. Issues and Factors to be Considered in Assessing Value

1	Public Input	
2	QRA Risk	
	a.	All available QRA risk measures, including expected fatalities, cancer incidences, fatalities at a one-in-a-billion probability, and probability of one or more fatalities
	b.	Risk tradeoffs: public versus worker, individual versus societal, processing versus storage, total risk versus remaining risk or campaign risk
	c.	Uncertainties in the technical assessments of risk
	d.	Insights from sensitivity studies
3	Hazard Evaluations	
4	HRA Risk	
	a.	Insights from sensitivity studies
5	Programmatic	
	a.	Cost of the change relative to other proposals and program objectives
	b.	Schedule for implementation
	c.	Uncertainties in estimates
	d.	Impact of implementation on overall objectives and schedule for disposal of the weapons and chemical agent
	e.	Consideration of the improvement anticipated by this change with other proposed improvements
6	Comparison to Previous Decisions	

Each change proposal is likely to involve unique circumstances and factors, so it is not possible to prescribe a set decision process with fixed criteria. It is, however,

important that *all* of the factors listed in table 9 be considered. Therefore, the final decision will be accompanied by a synopsis of the considerations and a summary of the overall decision basis, listing the rationale for each factor. The intent of the decision process is to explicitly consider all of the issues that could influence the decision. This is the normal process of responsible program management. The factors in table 9 are now discussed.

As indicated in table 9, the first factor (factor 1) is thorough consideration of public input gathered on the specific change. This will be an explicit consideration of the local communities and their perceptions of the desirability of the change. This input will be weighed with the other considerations.

The next four factors (2a through 2d) refer to the QRA. The public and worker risks described in section 7.1.4 will be considered. These risk results could offer significant insights important to the decision process. For example, the risk results might show a very substantial and measurable risk decrease that would be highly desirable. Alternatively, the potential exists for some risks to increase while others decrease. Public input regarding the different types of risk (public versus worker, societal versus individual, cancers versus acute fatalities) will be considered together with the Army's own understanding of the uncertainties in the assessed risks in coming to a decision as to the value of the change.

In a manner similar to that for the QRA risks, the impacts of the change on factor 3, hazard evaluations, will be examined. Trade-offs among different hazards will be considered, with a special focus on any hazards identified by the public as requiring special attention.

All changes that reach the value assessment portion of the change process will have already met the HRA standards. However, additional sensitivity analyses regarding health risk may be considered in the overall decision to provide additional insight that may lead to further safety measures (factor 4a).

The next five factors (5a through 5e) listed in table 9 are programmatic. These factors are part of the normal management process and are based on considerations of practicality, effectiveness, and efficiency. This is the opportunity to consider the proposed change in the context of the entire program, including costs, schedule, and other resources. This also allows the change to be considered together with other proposals, enabling consideration of which changes achieve the greatest overall beneficial impact. For example, it may be discovered through the process that a change would result in essentially no change in risk, would result in a cost savings, but would not meet the desired treaty schedule. Consideration within the context of other potential changes, public perceptions, and the overall program objectives may result in the change being reworked or rejected, even though risk was not affected.

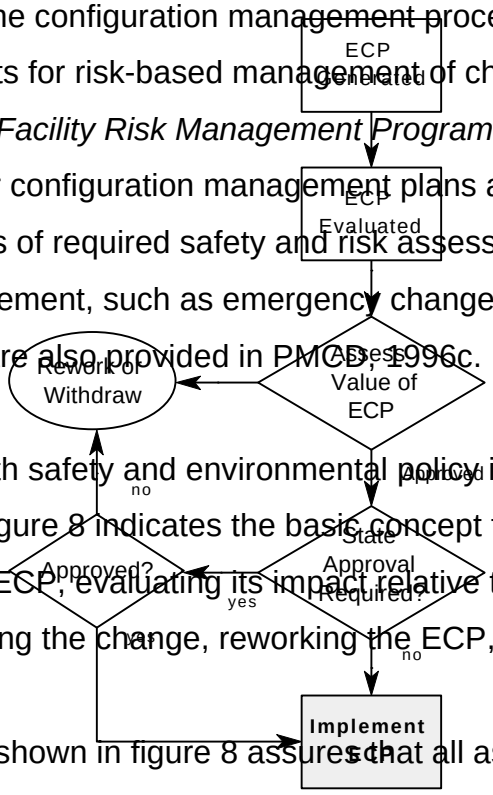
The Army decision and synopsis of factors affecting the decision will also form a basis for future decisions. Thus, the last factor (factor 6) is a review against previous decisions to ensure that decisions are consistent, or that reasons for changes are clearly understood.

The final decision of the Army will determine the status of the proposed change. The change may be rejected outright, or may be reworked to address the concerns that caused the rejection. If reworked, the change will be re-evaluated through the entire process. If accepted, the change must then enter the formal process for change at a site, as described in the next section.

7.2 Engineering Change Proposals

The change process is initiated as indicated in figure 7, which describes the process for subjecting some changes to augmented review and public participation. Change concepts that are approved through that process, and other changes not requiring the augmented review, are then implemented through the official mechanism for changing the plant — ECPs. The *Technical Configuration Management Plan* at each site (for example, PMCD, 1994) describes the ECP process in detail. A summary of the risk

management aspects of the configuration management procedure is provided here. Detailed CDF requirements for risk-based management of change are provided in the *Chemical Agent Disposal Facility Risk Management Program Requirements* (PMCD, 1996c). Requirements for configuration management plans and procedures are provided as are the details of required safety and risk assessments. In addition, other aspects of change management, such as emergency changes, temporary changes, waivers, and deviations, are also provided in PMCD, 1996c.



Only when compliance with safety and environmental policy is achieved can the change then be made. Figure 8 indicates the basic concept for the decision-making process in generating an ECP, evaluating its impact relative to the permit and safety, approving and implementing the change, reworking the ECP, or withdrawing the ECP.

The ECP evaluation step shown in figure 8 assures that all aspects of safety and risk considered in the established configuration are addressed in changes to that configuration. This effort uses the risk assessments described in section 4 and conforms with the change management provisions of the *System Safety Management Plan* (PMCD, 1996a). For changes subjected to the augmented review and public participation process, many of these assessments may have already been performed. The ECP evaluation is a thorough assessment of the complete ECP, including details of design and operation that may not have been fully specified when the augmented risk review was conducted. Figure 9 illustrates the ECP evaluation process. The result of this process is an understanding of the changes in the assessments (if any) induced by the ECP. Any changes are approved through the established risk authorization process, which is summarized in section 7.3.

Once evaluated, the value of the change is assessed. This decision is a combination of safety and risk considerations and programmatic considerations of cost, schedule, and

Figure 8. Risk-Based Management of Change

objectives. For changes that have already undergone an augmented review, the assessment takes into account any new information generated as a result of the specifics of the ECP. The approval process will be carried out in compliance with the *Chemical Stockpile Program Configuration Management Plan* (USACE, 1994).

Approval of the change may require state authorization if the permit is affected. Upon approval, implementation takes place according to the established configuration management plan. The implementation process includes provisions for update of documentation and training to ensure that the implementation is comprehensive.

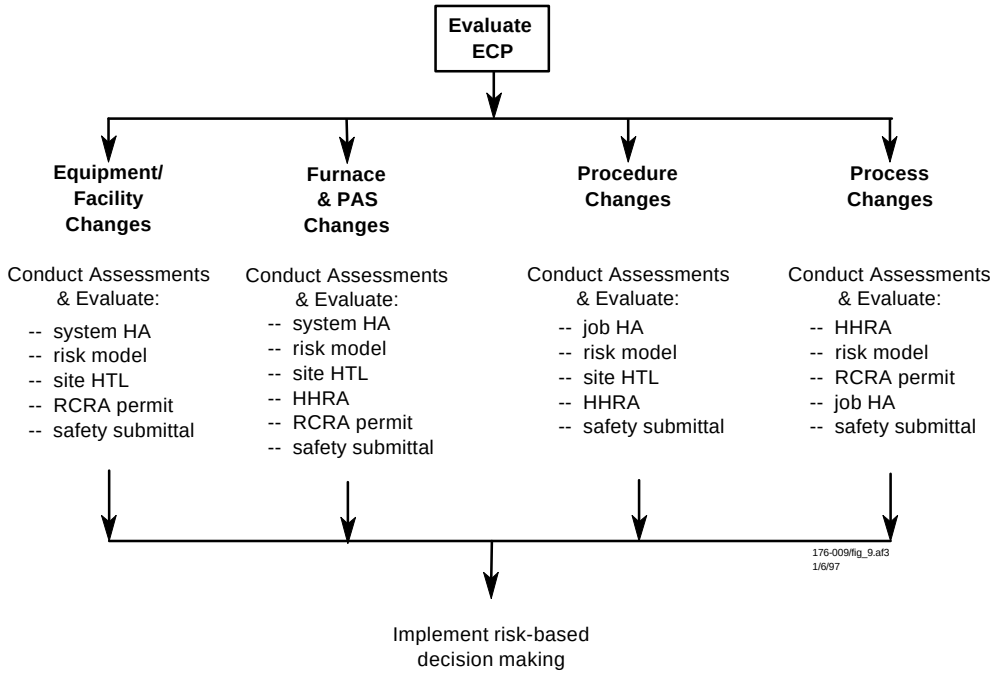


Figure 9. Evaluations Made in Accepting an ECP

7.3 Risk-Based Authorization

As with the initial establishment of the facility, management of change requires that changes be authorized using the process established in the SSMP and summarized in section 5.2. Figure 10 illustrates the safety risk approval process for ECPs.

Environmental risk authorization is based on comparison to pre-established acceptance criteria defined as part of the HRA as well as all other permit conditions. The change must be evaluated against all of these conditions, and state approval will be required for changes as established by the permit and prevailing law.

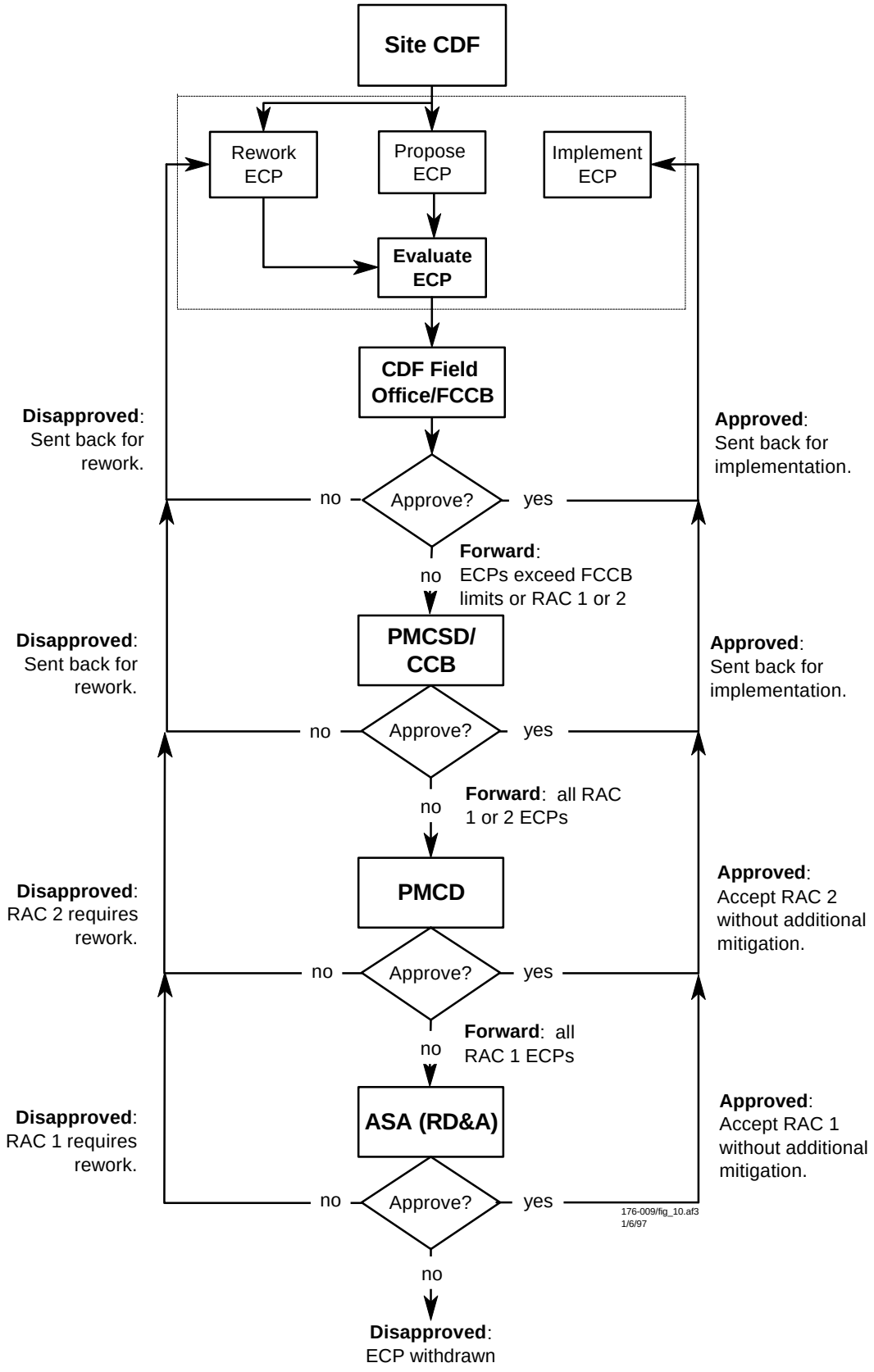


Figure 10. Safety Risk (RAC Authorization) Approval Process

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SECTION 8
PUBLIC PARTICIPATION

PMCD has implemented a Public Involvement and Outreach Program at every stockpile site to provide information to the public, receive feedback from the public, and enhance two-way dialogue during the chemical disposal program. This program was based on the results of focus group meetings and surveys that were conducted in the local communities to assess the public's informational needs and how the Army could best receive input from the public. [The results of those meetings and surveys are summarized in *Community Viewpoints of the Chemical Stockpile Disposal Program* (November 1994) and site-specific *Chemical Demilitarization Public Outreach Telephone Surveys* (1996).]

Chemical Activities have been established at all of the stockpile sites, and each has a PAO (with one or two public affairs specialists) to interact with the local public and Chemical Activity personnel. PMCD produced site-specific plans called *The Army's Guide to Community Outreach* for the Anniston, Pine Bluff, Pueblo, Blue Grass, and Umatilla Chemical Activities/Depots. Guides for the remaining sites are planned for completion in fiscal year (FY) 1997. These guides provide the Army's public affairs personnel (associated with the CSDP) with the information and communication tools necessary to conduct outreach efforts to the employees and communities surrounding the stockpile sites/CDFs.

To date, PMCD has established Community Outreach Offices in Anniston, Alabama; Richmond, Kentucky; Pine Bluff, Arkansas; Hermiston, Oregon; and Tooele, Utah. Additional offices will be opened in Pueblo, Colorado; Newport, Indiana; and Edgewood, Maryland, during FY 1997. These offices act like "libraries" or "storefronts" and house information for the public about the CSDP and other viewpoints. They are located in the local communities to give the public an opportunity to learn more about the program and provide input/feedback.

Recently, the NRC published a report recommending measures that the Army should take to involve the public in decision-making and oversight of the CSDP. The report, *Public Involvement and the Army Chemical Stockpile Disposal Program* (October 1996), recognized the Army's current outreach efforts and recommended that there should be an increased commitment to public involvement in the decision process.

SECTION 9

ORGANIZATIONAL RESPONSIBILITIES FOR RISK MANAGEMENT

PMCD manages risks using a hierarchical organization. As figure 11 indicates, PMCD is organizationally divided, with some of its subdivisions directed toward the major risk management functions.

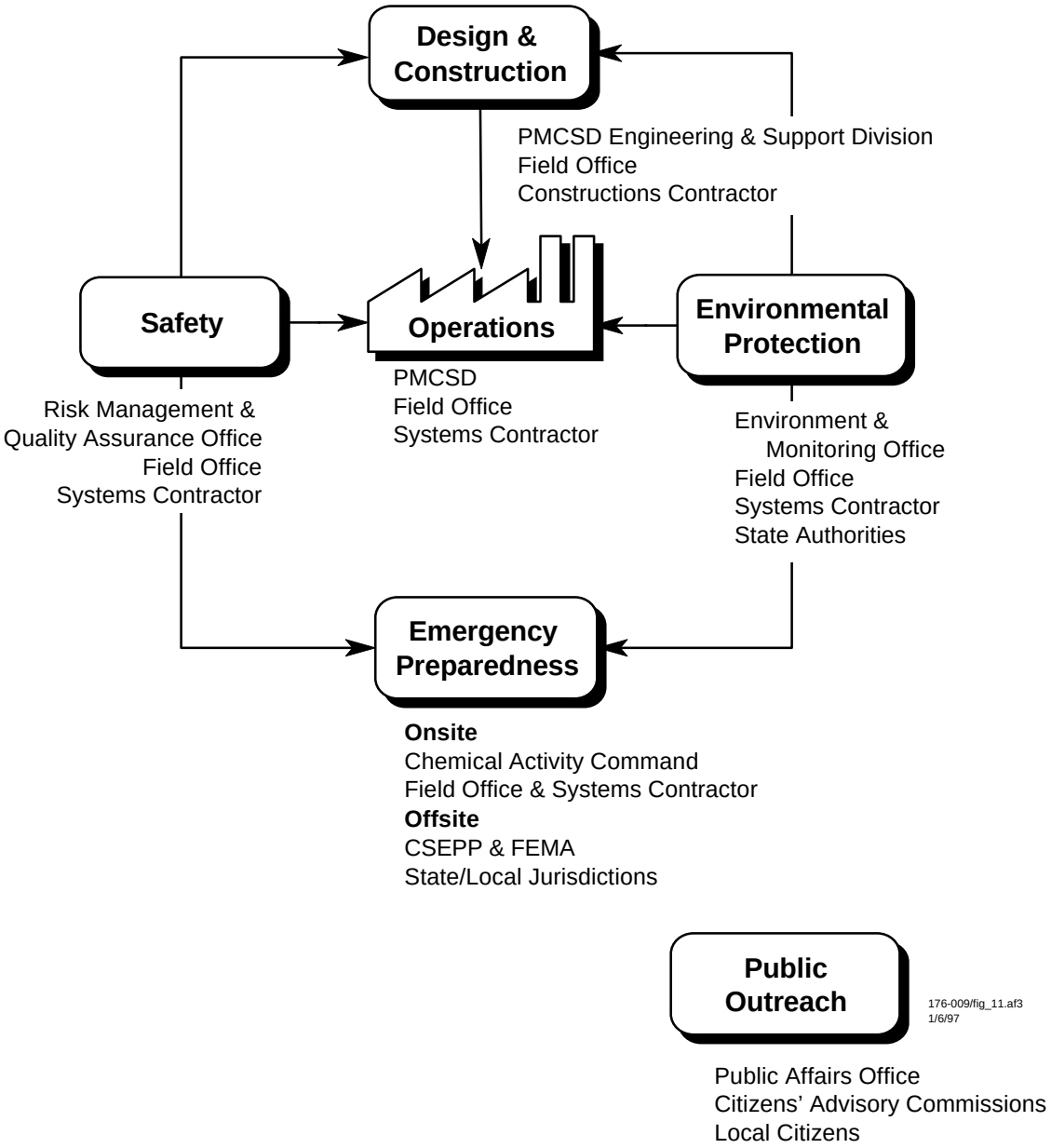

Figure 11. PMCD's Organizational Elements Directly Related to Risk Management

The management of risk is integrated into the PMCD management structure. Thus, the measures described previously are implemented as PMCD conducts its daily, as well as less frequent, risk management activities, that is, the practical aspects of risk management. The responsibilities for risk management can be considered in terms of the functions provided by various PMCD organizational units.

1. *Systemization and Operations*. PMCSD, through its field office, directs the daily operation of the existing CDFs as well as the design, operational, and training plans for future CDFs. The efforts of PMCSD directly impact the safety culture (IAEA, 1991) of the disposal activities.

   PMCD risk management is implemented at the CDFs by their systems contractors (SCs). The SC has the responsibilities for the daily operation of the CDF. The SC has a risk manager and a safety manager who together monitor safety and environmental compliance on a daily basis, assure that deviations are detected and identified to management, and ensure the safety and environmental assessment of all proposed changes to the facility and its operation.

2. *Safety*. The RM&QA Office supports PMCSD in the areas of safety, system safety, and accident risk. Safety risk management is implemented according to three recently updated PMCD regulations: PMCD R 385-1, *Safety Program* (PMCD, 1996d); PMCSD R 385-2, *System Safety Management Plan* (PMCD, 1996a); and PMCD R 385-3, *Incident and Accident Reporting, Investigating, and Records* (PMCD, 1996b). The risk management activities for each site are collected in the *Risk Management Program Requirements* document (PMCD, 1996c), which itemizes all onsite activities required to address risk management.

3. *Environmental Protection*. The E&M Office supports PMCSD in the areas of permitting, environmental compliance, and environmental monitoring.

This includes interface with the states on the human health and ecological risk assessments and the production of the programmatic EIS (PMCD, 1988) and the site-specific EISs.

4. *Emergency Preparedness.* The CSEPP Office coordinates the state and local emergency preparedness activities. As described in section 4, CSEPP has responsibility for improving the local and state jurisdiction emergency preparedness for communities near chemical weapons and agent storage installations. The offsite emergency preparedness activities are closely coordinated with FEMA, through agreements specified in the CSEPP charter (DA, 1994b) and a memorandum of understanding between the Army and FEMA (DA, 1994a). FEMA supports the Army by working with state and local governments through its existing offices and in coordination with the CSEPP office.

5. *Public Outreach*. PAO provides public outreach, receives information related to risk perceptions of the community at each site, and conducts other public participation activities related to the CDF site areas and surrounding communities. Risk communication and perception are major research areas related to risk management, as can be seen by the enormous literature on these subjects (PNL, 1994a, b; and for example, Sheldon, 1996; Keeney, 1995; Leiss, 1995; McDaniels, 1995; and Walker, 1995).

   Public outreach provides a two-way flow of risk-related information with the public in the local communities at the sites.

   1. *Risk Communication*. Effective and simple communication of the nature of the risks involved in chemical weapons disposal to the community.

2. *Risk Perception*. Open communication channels at each disposal site for the community to express and discuss its concerns related to the health, safety, and environmental implications of disposal.

There are other suborganizations, two of which support PMCD in its CSDP role. These are the Program Evaluation and Integration Office and the Resource Management Office. The Project Manager for Non-Stockpile Chemical Materiel has a role similar to PMCSD for non-stockpile activities. The Product Manager for Technology Exchange and the Product Manager for Alternative Technologies and Approaches are support elements of the CSDP not directly linked to risk management activities. Hence, the organizational units directly related to CSDP risk management are as indicated in figure 11.

PMCSD is the operational organization for CSDP. It implements its mission using PMCSD Field Offices and SCs. Those organizations for JACADS and TOCDF are already in place. Risk management at the CDFs consists of management systems, specific policies and procedures, and a safety-conscious attitude among all staff to ensure that the policies are successful. To ensure comprehensive risk management at each CDF, PMCD developed the *Chemical Agent Disposal Facility Risk Management Program Requirements* (PMCD, 1996c). These requirements establish the risk management activities to be conducted by the field office and systems contractor. Risk management at the CDFs has been organized into five principal functions: 1) establishment of safety, 2) management of change, 3) performance evaluation and followup, 4) effective incident investigation, and 5) emergency preparedness. A comprehensive list of CDF risk management activities is specified in PMCD, 1996c.

Table 10 indicates that the risk management tasks are tailored to the risk functions, and hence, according to figure 3, to the PMCD suborganizations. Evaluation is achieved through performance measures in the case of operations at PMCD and the sites; risk assessments in the case of safety and environmental protection; results of practices (drills) in the case of emergency preparedness; and discussions and written material from the public as feedback related to public participation.

Table 10. PMCD Risk Management Through Its Organizations and Functions

Organization/Risk Function	Risk Management Tasks		
	Evaluation	Authorization	Tracking
PMCSD/Operation	RMPR/COR	PMCSD Mission	RMPR Award Fee
RM&QA/Safety	RA	RAC Matrix	RMPR/HTL Award Fee
E&M/Environmental Protection	RA	State and Local Regulations	RMPR Deficiencies Award Fee
CSEPP/Emer. Preparedness	Drills	Graded Drills	n/a
PAO/Public Participation	Feedback	Acceptance	n/a

Notes:

Award fee = part of the contractual arrangement with CDF contractors that includes a performance-based fee, based heavily on safety and risk
COR = Field Office Contracting Officer's Representative
Drills = emergency response drills, feedback - information obtained from the local community
HTL = hazard tracking log
RA = risk assessment
RAC = risk assessment code
RMPR = *Risk Management Program Requirements* document

Authorization varies according to risk function. Of course, the mission of PMCSD is to run the program, and hence, this organization is the primary authorization. Safety functions are authorized according to the RAC authority matrix, and environmental protection functions are authorized according to the screening approach. For emergency preparedness, drills are conducted at the operating facilities and their performance is graded. And finally, public participation may face the toughest "authority," a skeptical public.

Tracking risks is the province of operation, safety, and environmental protection. This is done according to the PMCSD *Risk Management Program Requirements* (PMCD, 1996c) and the SSMP (PMCD, 1996a), in which safety has the additional database called the HTL.

The following fact sheets (tables 11 through 15) provide a synopsis of the context surrounding the risk functions as practiced by the PMCD/PMCSD. Note that interfaces and communication among the functions are designed into the program.

Table 11. Fact Sheet: A Synopsis of the Role of Systemization and Operations in Risk Management

PMCD Unit	PMCSD	
Regulator	Department of Defense (DoD) Department of the Army (DA) EPA (federal and state) OSHA	
Regulations	Numerous	
PMCD Regulations	CDF *Risk Management Program Requirements* (as a summary) (PMCD, 1996c)	
Subfunctions	Operations Maintenance Training Design and development Planning Safety Environmental protection	
Assessments	Comprehensive, as described under the safety and environmental protection functions	
Information to	Safety:	facility and process characterization, standard operating procedures (SOPs), and performance evaluation
	Environmental Protection:	monitoring and implementing compliance
	Emergency Preparedness:	personnel for exercises, training, planners
	Public Participation:	personnel and facility visits

Table 12. Fact Sheet: A Synopsis of the Role of Safety in Risk Management

PMCD Unit	RM&QA Office	
Regulator	DoD DA OSHA	
Regulations	Military Standard (MIL-STD) -882C, DoD 6055.9 STD Army Regulation (AR) 385-10, 385-16, 385-64, 385-40, 385-61, etc. 29 CFR 1910 (OSHA) 68 CFR Part 40 (EPA)	
PMCD Regulations	PMCD R 385-1, PMCSD R 385-2, PMCD R 385-3, and the CDF *Risk Management Program Requirements* document (PMCD, 1996c)	
Subfunctions	System safety Risk assessment and management Occupational safety Human health	
Assessments	FPEIS risk analysis System safety HEs and HTLs Site QRAs Special risk analyses	
Information to	Operation:	independent safety oversight; safety/risk requirements
	Environmental Protection:	identification of potential accidents
	Emergency Preparedness:	risk-significant accidents with frequencies and releases
	Public Participation:	risk insights and findings

Table 13. Fact Sheet: A Synopsis of the Role of Environmental Protection in Risk Management

PMCD Unit	E&M Office	
Regulator	State regulatory agencies Federal agencies EPA	
Regulations	State regulations on hazardous waste, toxic substances, clean air, and clean water 40 CFR including RCRA Parts A and B DA, AR 200-1	
PMCD Regulations	None specific	
Subfunctions	Permitting - construction, operation, emission, TSCA, clean water Meet generator standards of identification and tracking Meet treatment, storage and disposal standards of waste analysis, security, inspections, personnel training, special handling, location standards, preparedness, and prevention Meet incinerator standards with trial burns, automatic waste feed cutoffs, monitoring, process data acquisition, and reporting Meet air standards using stack monitoring	
Assessments	RCRA, Part B HHRA (HRA) and ERA EIS	
Information to	Operation:	parameters to monitor; compliance requirements
	Safety:	coordination
	Emergency Preparedness:	not applicable
	Public Participation:	risk insights and findings

Table 14. Fact Sheet: A Synopsis of the Role of Emergency Preparedness in Risk Management

PMCD Unit	CSEPP Office	
Regulator	State and local (county) emergency organizations	
Regulations	State regulations DA, AR 50-6 [chemical accident/incident response and assistance (CAIRA)]	
PMCD Regulations	None specific	
Subfunctions	Identify accident categories for planning Integrate with national CSEPP activities Coordinate with FEMA Coordinate with local (county) emergency organizations	
Assessments	n/a	
Information to	Operation:	personnel requirements
	Safety:	needed accident information
	Environmental Protection:	needed accident information
	Public Participation:	information for interface with local communities concerning preparedness

Table 15. Fact Sheet: A Synopsis of the Role of Public Participation in Risk Management

PMCD Unit	PAO	
Regulator	n/a	
Regulations	n/a	
PMCD Regulations	n/a	
Subfunctions	Continue public involvement and outreach activities Increase public participation avenues Train Army personnel in risk communication Enhance two-way dialogue with public	
Assessments	n/a	
Information to	Operation:	feedback of community input
	Safety:	feedback of community input
	Environmental Protection:	feedback of community input
	Emergency Preparedness:	feedback of community input

SECTION 10
SUMMARY

Management to minimize risk to workers, the public, and the environment is a paramount objective of the CSDP. To attain this goal, PMCD has established effective risk management systems, which are coordinated through five functions: systemization and operations, safety, environmental protection, emergency preparedness, and public outreach. As indicated in figure 12, these functions correlate with PMCD programmatic management and CDF responsibilities. Management responsibilities have been defined in section 9, including synopses in tables 11 through 15.

Risk management is aided by a series of assessments that offer an understanding of risk. As indicated in figure 12, these assessments can be correlated with specific risk management functions. These assessments also serve other functions, providing the necessary risk information to allow informed decision-making. The risk-related analyses are described in section 4, including a series of fact sheets in tables 3 through 8.

Decision-making is implemented within the PMCD management structure, aided by risk assessment inputs, and systemized through the RACs and authority matrices as summarized in section 5 and detailed in PMCD's *System Safety Management Plan*. Changes to the established site-specific configuration are accomplished through a detailed process described in section 7.

This guide focuses on PMCD risk management activities. These activities are conveyed to the site through the *Risk Management Program Requirements*. That document lists all the risk management functions and activities that must be performed at each CDF by the systems contractor in conjunction with the field office.

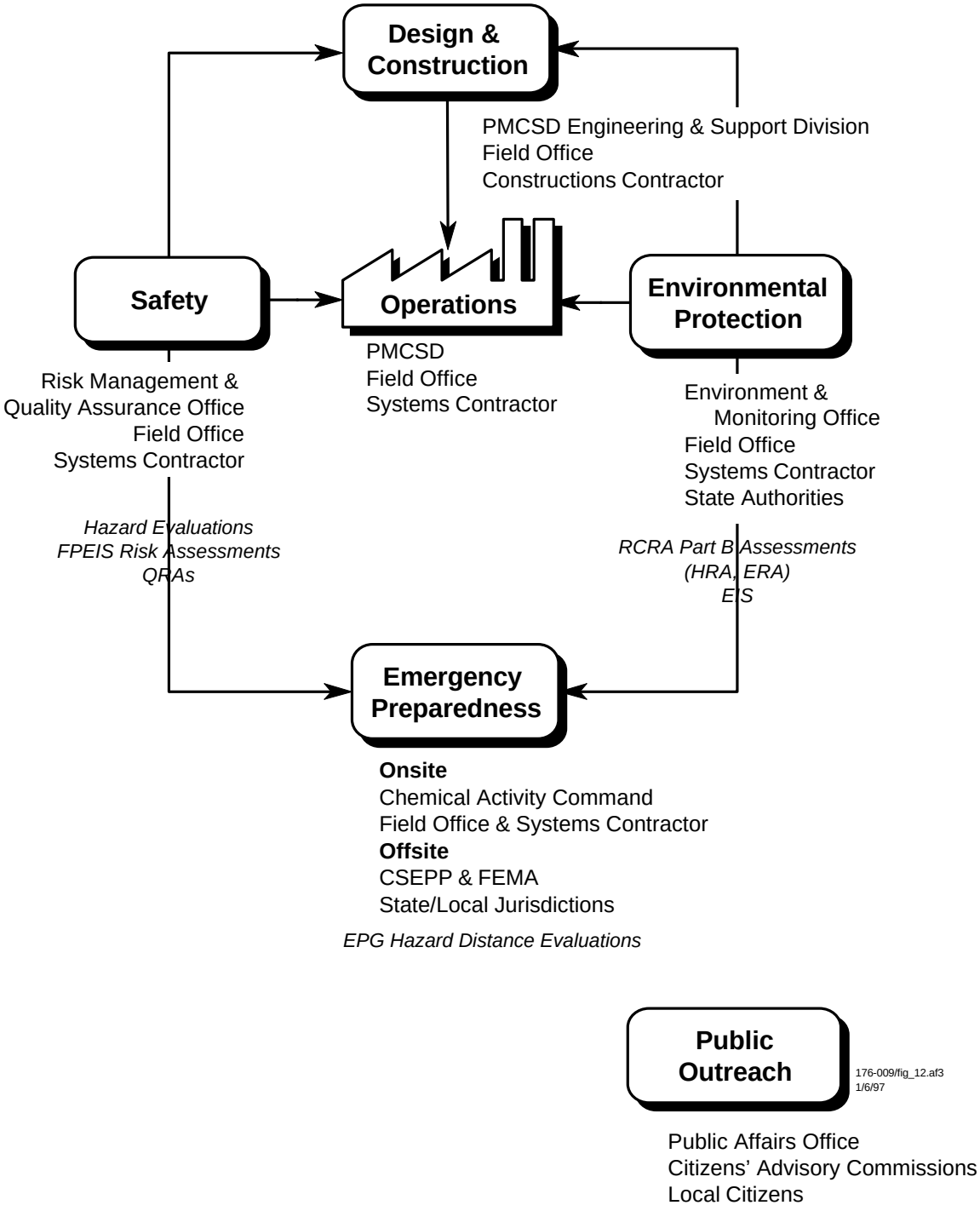

Figure 12. Risk Functions and Responsibilities

SECTION 11
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APPENDIX A

ACRONYMS/ABBREVIATIONS

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APBRG	Accident Planning Base Review Group
AR	Army Regulation
CAC	Citizens' Advisory Commission
CAIRA	chemical accident/incident response and assistance
CAMDs	Chemical Agent Munitions Disposal System
CDF	chemical agent disposal facility
COMPDEP	chronic air dispersion and deposition model (computer code)
CONUS	continental U.S.
COR	contracting officer's representative
CSDP	Chemical Stockpile Disposal Program
CSEPP	Chemical Stockpile Emergency Preparedness Project
DA	Department of the Army
DLL	Design Lessons Learned
DoD	Department of Defense
E&M	Environmental and Monitoring
ECP	Engineering Change Proposal
EIS	environmental impact statement
EPA	Environmental Protection Agency
EPG	emergency planning guide
ERA	ecological risk assessment
ERCP	Emergency Response Concept Plan
ERG	emergency response guide
FEMA	Federal Emergency Management Agency
FPEIS	Final Programmatic Environmental Impact Statement

FY	fiscal year
HE	hazard evaluation
HHRA	human health risk assessment
HQ	hazard quotient
HRA	health risk assessment (another name for the HHRA)
HTL	hazard tracking log
JACADS	Johnston Atoll Chemical Agent Disposal System
JHA	job hazard analysis
LCO	limits and conditions of operation
MIL-STD	Military Standard
NEPA	National Environmental Policy Act
NRC	National Research Council
OREMS	Oak Ridge Evacuation Modeling System
OSHA	Occupational Safety and Health Administration
PADRE	Protective Action Dose Reduction Estimator
PAO	Public Affairs Office
PHA	preliminary hazard analysis
PHL	preliminary hazards list
PL	Public Law
PLL	Programmatic Lessons Learned
PM	Program Manager
PMCD	Program Manager for Chemical Demilitarization
PMCSD	Project Manager for Chemical Stockpile Disposal

QRA	quantitative risk assessment
RA	risk assessment
RAC	risk assessment code
RCRA	Resource Conservation and Recovery Act
RM&QA	Risk Management and Quality Assurance
RMP	Risk Management Program
SC	Systems Contractor
SHA	system hazard analysis
SOP	standard operating procedure
SRA	screening risk assessment
SSMP	System Safety Management Plan
TOCDF	Tooele Chemical Agent Disposal Facility
TSCA	Toxic Substances Control Act

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APPENDIX B

RISK MANAGEMENT GLOSSARY

APPENDIX B
RISK MANAGEMENT GLOSSARY

The following terms are used in the risk management field frequently but not always with the same or a well-specified definition. Such a definition is offered in the following glossary.

Term	Definition
accident	• an abnormal event or series of events leading (or which may lead) to a human, biological, or environmental harm or loss • the Army sometimes uses the term *mishap* in system safety
emergency	an unlikely situation, which may be the result of an accident, with the potential for significant harm or loss
environmental	referring to the entire ecosystem in the surrounding vicinity of a CSDP system — affecting human health, socioeconomic resources, water quality, and aquatic and terrestrial resources
estimate	• an overall result of a quantitative assessment of risk; an estimate may be displayed as a number, a range of numbers, a curve, or a range of curves • an estimate may not be fully quantitative (for example, the Phase 1 QRAs do not assess uncertainty) and may not require the attempt to minimize conservatisms (for example, the HRAs)
preparedness	the phase of emergency management, sometimes referred to as *readiness*, which involves planning and training on how to respond to an emergency
programmatic risk	risk to the CSDP with regard to schedule or cost, including effects of influences outside CSDP control
qualitative	for the CSDP, *qualitative* is used to indicate the risk results that RAC-based hazard evaluations generate
quantitative	for the CSDP, *quantitative* is used to indicate the risk results that the detailed analyses of a QRA and HRA generate

Term	Definition
risk	• intuitively, the likelihood of harm or loss • technically, the composite of two distinct and potentially quantifiable elements: a) likelihood, which is indicated by probability or frequency b) consequences, which are the amount or degree of harm or loss
risk analysis/ assessment	1) the development of a qualitative ranking or a quantitative estimate of risk 2) the development of the understanding of what comprises the risk of a system so as to provide insights into the management of the risk these terms are used interchangeably here although a case may be made to distinguish them
risk communication	1) the presentation of the results of a system's risk assessment to different audiences including workers and the public 2) collection of information from interested parties regarding their perceptions of risk and risk management
risk management	the management of a system so as to assess and minimize its risks
risk perception	the personal, although usually informal, assessment of risk that includes the values, concerns, and beliefs of people in communities impacted by a hazardous technology
safety	a reasonable freedom from the causes of harm or loss
system	• a facility or mission within the CSDP including people, their organizations, procedures, materials, tools, equipment, and software • for programmatic issues, the CSDP is a system
system safety	an approach to achieve safety in a system by managing the risks of an organization and the interaction among people, their equipment, procedures, materials, tools, and software
technical risk	risks from the CSDP particularly as managed in relationship to one of the three risk management functions: safety, environmental protection, or emergency preparedness
uncertainty	any limitation in knowledge about risk; in a Phase 2 QRA, an estimate of the uncertainty in the risk estimate

APPENDIX C

ASSESSMENTS OF OFFSITE EFFECTS

APPENDIX C
ASSESSMENTS OF OFFSITE EFFECTS

Several of the risk assessment activities discussed in section 3 require evaluation of the potential for dispersion of chemical agent from the Army site. However, the objectives of each of the assessments are different, which sometimes leads to the use of different tools to assess these offsite consequences. While this is a reasonable approach, it can lead to some confusion since calculations with similar objectives are done with somewhat different methods and assumptions. An overview of these methods is provided in this appendix.

For agent releases, the Army has developed a computer model, D2PC (Whitacre, 1987; IEM, 1993), designed to simulate the aerosolization, evaporation, transport, diffusion, deposition, and inhalation of chemical agents. The model is a general Gaussian diffusion model used in the dispersion analysis of many risk assessments. The Army has specifically calibrated the D2PC model for chemical agents and has included field data from agent tests to help set the model parameters. However, given the simplicity of the model and the selection of assumptions, the model is generally conservative, in that it over-predicts the consequences, especially in site environments that do not have completely flat terrain. This conservatism with regard to potential hazard distances helps ensure that risk management of protective actions err on the side of safety. Generally, D2PC is used to predict a distance to a particular dosage, which can also be correlated with a specific level of health effect. D2PC is the basis for chemical agent dispersion calculations throughout the CSDP.

Two of the assessments described in section 3 use the D2PC program extensively. The FPEIS risk analyses, conducted in 1988 (PMCD, 1987, 1988), used the D2PC program to estimate doses and used that input to develop estimates of risk. Because of the magnitude of the problem of identifying all accidents and all associated weather conditions, the FPEIS used two standard weather conditions, one representing typical

weather (termed *conservative most likely*) and the other representing conditions that would lead to larger hazard distances (termed *worst case*). Because of the large number of accident sequences, hazard distances for some releases were interpolated rather than generated by specific code calculations. In this way, the use of D2PC with these two weather conditions formed the basis for all previous risk assessments (which are now being updated by the QRAs). In summary:

> *The FPEIS risk analyses used D2PC to calculate chemical agent doses for two standard weather conditions and used that information to develop estimates of risk.*

CSEPP uses D2PC extensively. The site-specific EPGs (for example, APBRG, 1996) are based on D2PC calculations. To date, the accident information for the EPGs has been derived from the FPEIS, along with some specific updates to the FPEIS to address specific issues, such as reconfiguration of munitions. The hazard distance calculations have been rerun with D2PC for each scenario. At the time of the FPEIS, some results were attained by interpolation. Therefore, the hazard distances produced in the EPGs can differ somewhat from those given in the FPEIS for the same release. Appendix C of the site-specific EPGs described the specific features of the hazard distance calculations.

> *The CSEPP program uses D2PC extensively in its planning as it would in an actual accident response, and the hazard distance information supplied in the EPGs is based on D2PC calculations for two standard weather conditions.*

CSEPP uses D2PC to address special issues, and local communities are trained to use D2PC in support of emergency preparedness. D2PC is also a tool that can assist in post-emergency decision-making regarding emergencies. CSEPP also uses other evaluation tools. The computer code PADRE is used to assist in emergency planning relative to the effects of protective actions such as sheltering, evacuation, and respiratory protection. In addition, evacuation times for local conditions are forecast

using OREMS. These codes are used exclusively in the emergency preparedness function of risk management and are not used to obtain estimates of risk.

The QRA (for example, SAIC, 1996) also requires estimates of offsite consequences. In keeping with the NRC requirement that the QRA use the latest available technology, a somewhat different calculation is performed. In order to appropriately characterize the risk, the consequence calculations must consider the full range of weather conditions that could occur and the probabilities of having those conditions. This is a very large computational problem that could not be practically approached through serial execution of D2PC. For the QRAs, the D2PC dispersion and dose models were incorporated into an existing QRA model developed for the nuclear industry (MACCS, Jow, 1990) that automates the calculations of consequences as a function of actual site-specific data. The new code, CHEMMACCS (Haskin, 1995), is used to automatically calculate risk after site-specific weather and population distributions are input. CHEMMACCS also allows simple modeling of protective actions such as sheltering and evacuation. Thus two objectives were achieved: 1) ensuring consistency with the Army's field-tested model, D2PC, and 2) accounting probabilistically for the variation in weather at a site. Instead of two sets of weather conditions, the QRA samples from a year of weather data appropriate for the site. In addition, the QRA is intended to model the situation as realistically as possible. The QRA consequence calculations therefore account for implementation of protective action, based on current protective action plans. Protective actions are included directly in the QRA risk results, although sensitivity studies without protective action are also provided. These changes to consequence calculations, while appropriate to the QRA, must be understood to be different from the FPEIS calculations and analyses of other releases using one or two weather conditions.

The QRA offsite consequences use CHEMMACCS, which contains the D2PC dispersion and dose models, but automates the probabilistic consideration of many weather conditions and includes protective action effects.

The EIS (for example, PMCD, 1995) also discusses offsite hazard distances. The EISs are based on information available at the time of preparation, and there will be differences as a result. The EISs for four sites will be based on risk analyses from the FPEIS, whereas the other four sites will be based on accident information from the QRA. The EISs based on the FPEIS use D2PC to calculate downwind hazards, and sensitivity analyses are also performed to determine important input parameters. Because the FPEIS consequences were grouped, the EIS uses the hazard distances associated with those groups, and hazard distances may be rounded up to specific values. Depending on the timing of publication, the EIS hazard distance information may not match the CSEPP distances exactly, since the CSEPP hazard distance analyses represent new calculations for specific releases, using updated information if available.

The EISs draw information from risk assessments and use D2PC to estimate hazard distances for the same two weather conditions as used by the FPEIS and CSEPP.

The screening risk assessment (SRA), including the HRA and the ERA, also requires estimation of offsite effects. The SRA is concerned with more than just agent and deals with routine, continuous releases of pollutants rather than one-time accidental releases. As a result, different tools are required. Based on EPA guidance (USEPA, 1994), SRA uses the chronic air dispersion and deposition (COMPDEP) model. This model was developed specifically for chronic exposure assessments. The COMPDEP model is not used in any of the other assessments supporting risk management. The SRA also assesses any potential for immediate effects of continuous releases using an EPA-approved model, BEEST-X.

The SRA (HRA & ERA) uses site-specific models that more realistically simulate continuous releases but are consistent with EPA guidance that have been developed for continuous rather than accidental releases and for a wide range of emissions rather than just agent.

In summary, there are different models used in the program to address different issues. While complete consistency would be ideal, in reality this cannot be attained because:

- Calculations are done for different, specific objectives

- Schedule dictates that some analyses be completed before others, so improvements in information or technology get factored into later studies, resulting in some differences relative to previously published information.

It is intended that this brief synopsis helps develop mutual understanding of some of these constraints to further ensure efficient integration across all CSDP functions.

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APPENDIX D

RCRA PERMIT MODIFICATION GUIDANCE

(excerpted from 40CFR, Ch I, 270.42)

Code of Federal Regulations
Revised as of July 1, 1996

TITLE 40--PROTECTION OF ENVIRONMENT AGENCY (CONTINUED)

PART 270--EPA ADMINISTERED PERMIT PROGRAMS: THE HAZARDOUS WASTE PERMIT PROGRAM--Table of Contents

Subpart D--Changes to Permit

Sec. 270.42 Permit modification at the request of the permittee.

(a) Class 1 modifications.
(1) Except as provided in paragraph (a)(2) of this section, the permittee may put into effect Class 1 modifications listed in appendix I of this section under the following conditions:
(i) The permittee must notify the Director concerning the modification by certified mail or other means that establish proof of delivery within 7 calendar days after the change is put into effect. This notice must specify the changes being made to permit conditions or supporting documents referenced by the permit and must explain why they are necessary. Along with the notice, the permittee must provide the applicable information required by Secs. 270.13 through 270.21, 270.62, and 270.63.
(ii) The permittee must send a notice of the modification to all persons on the facility mailing list, maintained by the Director in accordance with 40 CFR 124.10(c)(viii), and the appropriate units of State and local government, as specified in 40 CFR 124.10(c)(ix). This notification must be made within 90 calendar days after the change is put into effect. For the Class I modifications that require prior Director approval, the notification must be made within 90 calendar days after the Director approves the request.
(iii) Any person may request the Director to review, and the Director may for cause reject, any Class 1 modification. The Director must inform the permittee by certified mail that a Class 1 modification has been rejected, explaining the reasons for the rejection. If a Class 1 modification has been rejected, the permittee must comply with the original permit conditions.
(2) Class 1 permit modifications identified in appendix I by an asterisk may be made only with the prior written approval of the Director.
(3) For a Class 1 permit modification, the permittee may elect to follow the procedures in Sec. 270.42(b) for Class 2 modifications instead of the Class 1 procedures. The permittee must inform the Director of this decision in the notice required in Sec. 270.42(b)(1).
(b) Class 2 modifications.
(1) For Class 2 modifications, listed in appendix I of this section, the permittee must submit a modification request to the Director that:
(i) Describes the exact change to be made to the permit conditions and supporting documents referenced by the permit;
(ii) Identifies that the modification is a Class 2 modification;
(iii) Explains why the modification is needed; and
(iv) Provides the applicable information required by Secs. 270.13 through 270.21, 270.62, and 270.63.
(2) The permittee must send a notice of the modification request to all persons on the facility mailing list maintained by the Director and to the appropriate units of State and local government as specified in 40 CFR 124.10(c)(ix) and must publish this notice in a major local newspaper of general circulation. This notice must be mailed and published within 7 days before or after the date of submission of the modification request, and the permittee must provide to the Director evidence of the mailing and publication. The notice must include:
(i) Announcement of a 60-day comment period, in accordance with Sec. 270.42(b)(5), and the name and address of an Agency contact to whom comments must be sent;
(ii) Announcement of the date, time, and place for a public meeting held in accordance with Sec. 270.42(b)(4);
(iii) Name and telephone number of the permittee's contact person;
(iv) Name and telephone number of an Agency contact person;
(v) Location where copies of the modification request and any supporting documents can be viewed and copied; and

(vi) The following statement: “The permittee's compliance history during the life of the permit being modified is available from the Agency contact person.''

(3) The permittee must place a copy of the permit modification request and supporting documents in a location accessible to the public in the vicinity of the permitted facility.

(4) The permittee must hold a public meeting no earlier than 15 days after the publication of the notice required in paragraph (b)(2) of this section and no later than 15 days before the close of the 60-day comment period. The meeting must be held to the extent practicable in the vicinity of the permitted facility.

(5) The public shall be provided 60 days to comment on the modification request. The comment period will begin on the date the permittee publishes the notice in the local newspaper. Comments should be submitted to the Agency contact identified in the public notice.

(6)(i) No later than 90 days after receipt of the notification request, the Director must:

(A) Approve the modification request, with or without changes, and modify the permit accordingly;

(B) Deny the request;

(C) Determine that the modification request must follow the procedures in Sec. 270.42(c) for Class 3 modifications for the following reasons:

(1) There is significant public concern about the proposed modification; or

(2) The complex nature of the change requires the more extensive procedures of Class 3.

(D) Approve the request, with or without changes, as a temporary authorization having a term of up to 180 days, or

(E) Notify the permittee that he or she will decide on the request within the next 30 days.

(ii) If the Director notifies the permittee of a 30-day extension for a decision, the Director must, no later than 120 days after receipt of the modification request:

(A) Approve the modification request, with or without changes, and modify the permit accordingly;

(B) Deny the request; or

(C) Determine that the modification request must follow the procedures in Sec. 270.42(c) for Class 3 modifications for the following reasons:

(1) There is significant public concern about the proposed modification; or

(2) The complex nature of the change requires the more extensive procedures of Class 3.

(D) Approve the request, with or without changes, as a temporary authorization having a term of up to 180 days.

(iii) If the Director fails to make one of the decisions specified in paragraph (b)(6)(ii) of this section by the 120th day after receipt of the modification request, the permittee is automatically authorized to conduct the activities described in the modification request for up to 180 days, without formal Agency action. The authorized activities must be conducted as described in the permit modification request and must be in compliance with all appropriate standards of 40 CFR part 265. If the Director approves, with or without changes, or denies the modification request during the term of the temporary or automatic authorization provided for in paragraphs (b)(6) (i), (ii), or (iii) of this section, such action cancels the temporary or automatic authorization.

(iv)(A) In the case of an automatic authorization under paragraph (b)(6)(iii) of this section, or a temporary authorization under paragraph (b)(6) (i)(D) or (ii)(D) of this section, if the Director has not made a final approval or denial of the modification request by the date 50 days prior to the end of the temporary or automatic authorization, the permittee must within seven days of that time send a notification to persons on the facility mailing list, and make a reasonable effort to notify other persons who submitted written comments on the modification request, that:

(1) The permittee has been authorized temporarily to conduct the activities described in the permit modification request, and

(2) Unless the Director acts to give final approval or denial of the request by the end of the authorization period, the permittee will receive authorization to conduct such activities for the life of the permit.

(B) If the owner/operator fails to notify the public by the date specified in paragraph (b)(6)(iv)(A) of this section, the effective date of the permanent authorization will be deferred until 50 days after the owner/operator notifies the public.

(v) Except as provided in paragraph (b)(6)(vii) of this section, if the Director does not finally approve or deny a modification request before the end of the automatic or temporary authorization period or reclassify the modification as a Class 3, the permittee is authorized to conduct the activities described in the permit modification request for the life of the permit unless modified later under Sec. 270.41 or

Sec. 270.42. The activities authorized under this paragraph must be conducted as described in the permit modification request and must be in compliance with all appropriate standards of 40 CFR part 265.

(vi) In making a decision to approve or deny a modification request, including a decision to issue a temporary authorization or to reclassify a modification as a Class 3, the Director must consider all written comments submitted to the Agency during the public comment period and must respond in writing to all significant comments in his or her decision.

(vii) With the written consent of the permittee, the Director may extend indefinitely or for a specified period the time periods for final approval or denial of a modification request or for reclassifying a modification as a Class 3.

(7) The Director may deny or change the terms of a Class 2 permit modification request under paragraphs (b)(6) (i) through (iii) of this section for the following reasons:

(i) The modification request is incomplete;

(ii) The requested modification does not comply with the appropriate requirements of 40 CFR part 264 or other applicable requirements; or

(iii) The conditions of the modification fail to protect human health and the environment.

(8) The permittee may perform any construction associated with a Class 2 permit modification request beginning 60 days after the submission of the request unless the Director establishes a later date for commencing construction and informs the permittee in writing before day 60.

(c) Class 3 modifications.

(1) For Class 3 modifications listed in appendix I of this section, the permittee must submit a modification request to the Director that:

(i) Describes the exact change to be made to the permit conditions and supporting documents referenced by the permit;

(ii) Identifies that the modification is a Class 3 modification;

(iii) Explains why the modification is needed; and

(iv) Provides the applicable information required by 40 CFR 270.13 through 270.22, 270.62, 270.63, and 270.66.

(2) The permittee must send a notice of the modification request to all persons on the facility mailing list maintained by the Director and to the appropriate units of State and local government as specified in 40 CFR 124.10(c)(ix) and must publish this notice in a major local newspaper of general circulation. This notice must be mailed and published within seven days before or after the date of submission of the modification request, and the permittee must provide to the Director evidence of the mailing and publication. The notice must include:

(i) Announcement of a 60-day comment period, and a name and address of an Agency contact to whom comments must be sent;

(ii) Announcement of the date, time, and place for a public meeting on the modification request, in accordance with Sec. 270.42(c)(4);

(iii) Name and telephone number of the permittee's contact person;

(iv) Name and telephone number of an Agency contact person;

(v) Location where copies of the modification request and any supporting documents can be viewed and copied; and

(vi) The following statement: "The permittee's compliance history during the life of the permit being modified is available from the Agency contact person."

(3) The permittee must place a copy of the permit modification request and supporting documents in a location accessible to the public in the vicinity of the permitted facility.

(4) The permittee must hold a public meeting no earlier than 15 days after the publication of the notice required in paragraph (c)(2) of this section and no later than 15 days before the close of the 60-day comment period. The meeting must be held to the extent practicable in the vicinity of the permitted facility.

(5) The public shall be provided at least 60 days to comment on the modification request. The comment period will begin on the date the permittee publishes the notice in the local newspaper. Comments should be submitted to the Agency contact identified in the notice.

(6) After the conclusion of the 60-day comment period, the Director must grant or deny the permit modification request according to the permit modification procedures of 40 CFR part 124. In addition, the

Director must consider and respond to all significant written comments received during the 60-day comment period.

(d) Other modifications.
(1) In the case of modifications not explicitly listed in appendix I of this section, the permittee may submit a Class 3 modification request to the Agency, or he or she may request a determination by the Director that the modification should be reviewed and approved as a Class 1 or Class 2 modification. If the permittee requests that the modification be classified as a Class 1 or 2 modification, he or she must provide the Agency with the necessary information to support the requested classification.
(2) The Director shall make the determination described in paragraph (d)(1) of this section as promptly as practicable. In determining the appropriate class for a specific modification, the Director shall consider the similarity of the modification to other modifications codified in appendix I and the following criteria:
(i) Class 1 modifications apply to minor changes that keep the permit current with routine changes to the facility or its operation. These changes do no substantially alter the permit conditions or reduce the capacity of the facility to protect human health or the environment. In the case of Class 1 modifications, the Director may require prior approval.
(ii) Class 2 modifications apply to changes that are necessary to enable a permittee to respond, in a timely manner, to,
(A) Common variations in the types and quantities of the wastes managed under the facility permit,
(B) Technological advancements, and
(C) Changes necessary to comply with new regulations, where these changes can be implemented without substantially changing design specifications or management practices in the permit.
(iii) Class 3 modifications substantially alter the facility or its operation.
(e) Temporary authorizations.
(1) Upon request of the permittee, the Director may, without prior public notice and comment, grant the permittee a temporary authorization in accordance with this subsection. Temporary authorizations must have a term of not more than 180 days.
(2)(i) The permittee may request a temporary authorization for:
(A) Any Class 2 modification meeting the criteria in paragraph (e)(3)(ii) of this section, and
(B) Any Class 3 modification that meets the criteria in paragraph (3)(ii) (A) or (B) of this section; or that meets the criteria in paragraphs (3)(ii) (C) through (E) of this section and provides improved management or treatment of a hazardous waste already listed in the facility permit.
(ii) The temporary authorization request must include:
(A) A description of the activities to be conducted under the temporary authorization;
(B) An explanation of why the temporary authorization is necessary; and
(C) Sufficient information to ensure compliance with 40 CFR part 264 standards.
(iii) The permittee must send a notice about the temporary authorization request to all persons on the facility mailing list maintained by the Director and to appropriate units of State and local governments as specified in 40 CFR 124.10(c)(ix). This notification must be made within seven days of submission of the authorization request.
(3) The Director shall approve or deny the temporary authorization as quickly as practical. To issue a temporary authorization, the Director must find:
(i) The authorized activities are in compliance with the standards of 40 CFR part 264.
(ii) The temporary authorization is necessary to achieve one of the following objectives before action is likely to be taken on a modification request:
(A) To facilitate timely implementation of closure or corrective action activities;
(B) To allow treatment or storage in tanks or containers, or in containment buildings in accordance with 40 CFR part 268;
(C) To prevent disruption of ongoing waste management activities;
(D) To enable the permittee to respond to sudden changes in the types or quantities of the wastes managed under the facility permit; or
(E) To facilitate other changes to protect human health and the environment.
(4) A temporary authorization may be reissued for one additional term of up to 180 days provided that the permittee has requested a Class 2 or 3 permit modification for the activity covered in the temporary authorization, and:
(i) The reissued temporary authorization constitutes the Director's decision on a Class 2 permit modification in accordance with paragraph (b)(6)(i)(D) or (ii)(D) of this section, or

(ii) The Director determines that the reissued temporary authorization involving a Class 3 permit modification request is warranted to allow the authorized activities to continue while the modification procedures of paragraph (c) of this section are conducted.

(f) Public notice and appeals of permit modification decisions.

(1) The Director shall notify persons on the facility mailing list and appropriate units of State and local government within 10 days of any decision under this section to grant or deny a Class 2 or 3 permit modification request. The Director shall also notify such persons within 10 days after an automatic authorization for a Class 2 modification goes into effect under Sec. 270.42(b)(6) (iii) or (v).

(2) The Director's decision to grant or deny a Class 2 or 3 permit modification request under this section may be appealed under the permit appeal procedures of 40 CFR 124.19.

(3) An automatic authorization that goes into effect under Sec. 270.42(b)(6) (iii) or (v) may be appealed under the permit appeal procedures of 40 CFR 124.19; however, the permittee may continue to conduct the activities pursuant to the automatic authorization until the appeal has been granted pursuant to Sec. 124.19(c), notwithstanding the provisions of Sec. 124.15(b).

(g) Newly regulated wastes and units.

(1) The permittee is authorized to continue to manage wastes listed or identified as hazardous under part 261 of this chapter, or to continue to manage hazardous waste in units newly regulated as hazardous waste management units, if:

(i) The unit was in existence as a hazardous waste facility with respect to the newly listed or characterized waste or newly regulated waste management unit on the effective date of the final rule listing or identifying the waste, or regulating the unit;

(ii) The permittee submits a Class 1 modification request on or before the date on which the waste or unit becomes subject to the new requirements;

(iii) The permittee is in compliance with the applicable standards of 40 CFR parts 265 and 266 of this chapter;

(iv) The permittee also submits a complete Class 2 or 3 modification request within 180 days of the effective date of the rule listing or identifying the waste, or subjecting the unit to RCRA Subtitle C management standards;

(v) In the case of land disposal units, the permittee certifies that each such unit is in compliance with all applicable requirements of part 265 of this chapter for groundwater monitoring and financial responsibility on the date 12 months after the effective date of the rule identifying or listing the waste as hazardous, or regulating the unit as a hazardous waste management unit. If the owner or operator fails to certify compliance with all these requirements, he or she will lose authority to operate under this section.

(2) New wastes or units added to a facility's permit under this subsection do not constitute expansions for the purpose of the 25 percent capacity expansion limit for Class 2 modifications.

(h) Permit modification list. The Director must maintain a list of all approved permit modifications and must publish a notice once a year in a State-wide newspaper that an updated list is available for review.

Appendix I to Sec. 270.42--Classification of Permit Modification

Modifications			Class
A.	General Permit Provisions		
	1.	Administrative and informational changes	1
	2.	Correction of typographical errors	1
	3.	Equipment replacement or upgrading with functionally equivalent components (e.g., pipes, valves, pumps, conveyors, controls)	1
	4.	Changes in the frequency of or procedures for monitoring, reporting, sampling, or maintenance activities by the permittee:	
		a. To provide for more frequent monitoring, reporting, sampling, or maintenance	1
		b. Other changes	2

Appendix I to Sec. 270.42--Classification of Permit Modification (Continued)

Modifications	Class
5. Schedule of compliance:	
a. Changes in interim compliance dates, with prior approval of the Director	[1]1
b. Extension of final compliance date	3
6. Changes in expiration date of permit to allow earlier permit termination, with prior approval of the Director	[1]1
7. Changes in ownership or operational control of a facility, provided the procedures of Sec. 270.40(b) are followed	[1]1
B. General Facility Standards	
1. Changes to waste sampling or analysis methods:	
a. To conform with agency guidance or regulations	1
b. To incorporate changes associated with F039 (multi-source leachate) sampling or analysis methods	1
c. To incorporate changes associated with underlying hazardous constituents in ignitable or corrosive wastes	[1]1
d. Other changes	2
2. Changes to analytical quality assurance/control plan:	
a. To conform with agency guidance or regulations	1
b. Other changes	2
3. Changes in procedures for maintaining the operating record	1
4. Changes in frequency or content of inspection schedules	2
5. Changes in the training plan:	
a. That affect the type or decrease the amount of training given to employees	2
b. Other changes	1
6. Contingency plan:	
a. Changes in emergency procedures (i.e., spill or release response procedures)	2
b. Replacement with functionally equivalent equipment, upgrade, or relocate emergency equipment listed	1
c. Removal of equipment from emergency equipment list	2
d. Changes in name, address, or phone number of coordinators or other persons or agencies identified in the plan	1

Modifications	Class
7. Construction quality assurance plan:	
a. Changes that the CQA officer certifies in the operating record will provide equivalent or better certainty that the unit components meet the design specifications	1
b. Other changes	2
Note: When a permit modification (such as introduction of a new unit) requires a change in facility plans or other general facility standards, that change shall be reviewed under the same procedures as the permit modification.	
C. Ground-Water Protection	
1. Changes to wells:	
a. Changes in the number, location, depth, or design of upgradient or downgradient wells of permitted ground-water monitoring system	2
b. Replacement of an existing well that has been damaged or rendered inoperable, without change to location, design, or depth of the well	1
2. Changes in ground-water sampling or analysis procedures or monitoring schedule, with prior approval of the Director	[1]1
3. Changes in statistical procedure for determining whether a statistically significant change in ground-water quality between upgradient and downgradient wells has occurred, with prior approval of the Director	[1]1
4. Changes in point of compliance	[1]2
5. Changes in indicator parameters, hazardous constituents, or concentration limits (including ACLs):	
a. As specified in the groundwater protection standard	3
b. As specified in the detection monitoring program	2
6. Changes to a detection monitoring program as required by Sec. 264.98(j), unless otherwise specified in this appendix	2
7. Compliance monitoring program:	
a. Addition of compliance monitoring program as required by Secs. 264.98(h)(4) and 264.99	3
b. Changes to a compliance monitoring program as required by Sec. 264.99(k), unless otherwise specified in this appendix	2
8. Corrective action program:	
a. Addition of a corrective action program as required by Secs. 264.99(i)(2) and 264.100	3
b. Changes to a corrective action program as required by Sec. 264.100(h), unless otherwise specified in this appendix	2

Appendix I to Sec. 270.42--Classification of Permit Modification (Continued)

Modifications	Class
D. Closure	
1. Changes to the closure plan:	
a. Changes in estimate of maximum extent of operations or maximum inventory of waste on-site at any time during the active life of the facility, with prior approval of the Director	[1]1
b. Changes in the closure schedule for any unit, changes in the final closure schedule for the facility, or extension of the closure period, with prior approval of the Director	[1]1
c. Changes in the expected year of final closure, where other permit conditions are not changed, with prior approval of the Director	[1]1
d. Changes in procedures for decontamination of facility equipment or structures, with prior approval of the Director	[1]1
e. Changes in approved closure plan resulting from unexpected events occurring during partial or final closure, unless otherwise specified in this appendix	2
f. Extension of the closure period to allow a landfill, surface impoundment or land treatment unit to receive non-hazardous wastes after final receipt of hazardous wastes under Sec. 264.113 (d) and (e)	2
2. Creation of a new landfill unit as part of closure	3
3. Addition of the following new units to be used temporarily for closure activities:	
a. Surface impoundments	3
b. Incinerators	3
c. Waste piles that do not comply with Sec. 264.250(c)	3
d. Waste piles that comply with Sec. 264.250(c)	2
e. Tanks or containers (other than specified below)	2
f. Tanks used for neutralization, dewatering, phase separation, or component separation, with prior approval of the Director	[1]1
E. Post-Closure	
1. Changes in name, address, or phone number of contact in post-closure plan	1
2. Extension of post-closure care period	2
3. Reduction in the post-closure care period	3
4. Changes to the expected year of final closure, where other permit conditions are not changed	1
5. Changes in post-closure plan necessitated by events occurring during the active life of the facility, including partial and final closure	2

Appendix I to Sec. 270.42--Classification of Permit Modification (Continued)

Modifications	Class
F. Containers	
1. Modification or addition of container units:	
a. Resulting in greater than 25% increase in the facility's container storage capacity, except as provided in F(1)(c) and F(4)(a) below	3
b. Resulting in up to 25% increase in the facility's container storage capacity, except as provided in F(1)(c) and F(4)(a) below	2
c. Or treatment processes necessary to treat wastes that are restricted from land disposal to meet some or all of the applicable treatment standards or to treat wastes to satisfy (in whole or in part) the standard of "use of practically available technology that yields the greatest environmental benefit" contained in Sec. 268.8(a)(2)(ii), with prior approval of the Director. This modification may also involve addition of new waste codes or narrative descriptions of wastes. It is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	[1]1
2. a. Modification of a container unit without increasing the capacity of the unit	2
b. Addition of a roof to a container unit without alteration of the containment system	1
3. Storage of different wastes in containers, except as provided in (F)(4) below:	
a. That require additional or different management practices from those authorized in the permit	3
b. That do not require additional or different management practices from those authorized in the permit	2
Note: See Sec. 270.42(g) for modification procedures to be used for the management of newly listed or identified wastes.	
4. Storage of treatment of different wastes in containers:	
a. That require addition of units or change in treatment process or management standards, provided that the wastes are restricted from land disposal and are to be treated to meet some or all of the applicable treatment standards, or that are to be treated to satisfy (in whole or in part) the standard of "use of practically available technology that yields the greatest environmental benefit" contained in Sec. 268.8(a)(2)(ii). This modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	1
b. That do not require the addition of units or a change in the treatment process or management standards, and provided that the units have previously received wastes of the same type (e.g., incinerator scrubber water). This modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	[1]1

Appendix I to Sec. 270.42--Classification of Permit Modification (Continued)

Modifications			Class
G.	Tanks		
	1.	a. Modification or addition of tank units resulting in greater than 25% increase in the facility's tank capacity, except as provided in G(1)(c), G(1)(d), and G(1)(e) below	3
		b. Modification or addition of tank units resulting in up to 25% increase in the facility's tank capacity, except as provided in G(1)(d) and G(1)(e) below	2
		c. Addition of a new tank that will operate for more than 90 days using any of the following physical or chemical treatment technologies: neutralization, dewatering, phase separation, or component separation	2
		d. After prior approval of the Director, addition of a new tank that will operate for up to 90 days using any of the following physical or chemical treatment technologies: neutralization, dewatering, phase separation, or component separation	[1]1
		e. Modification or addition of tank units or treatment processes necessary to treat wastes that are restricted from land disposal to meet some or all of the applicable treatment standards or to treat wastes to satisfy (in whole or in part) the standard of "use of practically available technology that yields the greatest environmental benefit" contained in Sec. 268.8(a)(2)(ii), with prior approval of the Director. This modification may also involve addition of new waste codes. It is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	[1]1
	2.	Modification of a tank unit or secondary containment system without increasing the capacity of the unit	2
	3.	Replacement of a tank with a tank that meets the same design standards and has a capacity within +/-10% of the replaced tank provided	1
		-- The capacity difference is no more than 1500 gallons,	
		-- The facility's permitted tank capacity is not increased, and	
		-- The replacement tank meets the same conditions in the permit.	
	4.	Modification of a tank management practice	2
	5.	Management of different wastes in tanks:	
		a. That require additional or different management practices, tank design, different fire protection specifications, or significantly different tank treatment process from that authorized in the permit, except as provided in (G)(5)(c) below	3
		b. That do not require additional or different management practices, tank design, different fire protection specifications, or significantly different tank treatment process than authorized in the permit, except as provided in (G)(5)(d)	2

Modifications	Class
c. That require addition of units or change in treatment processes or management standards, provided that the wastes are from land disposal and are to be treated to meet some or all of the applicable treatment standards or that are to be treated to satisfy (in whole or in part) the standard of "use of practically available technology that yields the greatest environmental benefit" contained in Sec. 268.8(a)(2)(ii). The modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	[1]1
d. That do not require the addition of units or a change in the treatment process or management standards, and provided that the units have previously received wastes of the same type (e.g., incinerator scrubber water). This modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	1
Note: See Sec. 270.42(g) for modification procedures to be used for the management of newly listed or identified wastes.	
H. Surface Impoundments	
1. Modification or addition of surface impoundment units that result in increasing the facility's surface impoundment storage or treatment capacity	3
2. Replacement of a surface impoundment unit	3
3. Modification of a surface impoundment unit without increasing the facility's surface impoundment storage or treatment capacity and without modifying the unit's liner, leak detection system, or leachate collection system	2
4. Modification of a surface impoundment management practice	2
5. Treatment, storage, or disposal of different wastes in surface impoundments:	
a. That require additional or different management practices or different design of the liner or leak detection system than authorized in the permit	3
b. That do not require additional or different management practices or different design of the liner or leak detection system than authorized in the permit	2
c. That are wastes restricted from land disposal that meet the applicable treatment standards or that are treated to satisfy the standard of "use of practically available technology that yields the greatest environmental benefit" contained in Sec. 269.8(a)(2)(ii), and provided that the unit meets the minimum technological requirements stated in Sec. 268.5(h)(2). This modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	1
d. That are residues from wastewater treatment or incineration, provided that disposal occurs in a unit that meets the minimum technological requirements stated in Sec. 268.5(h)(2), and provided further that the surface impoundment has previously received wastes of the same type (for example, incinerator scrubber water). This modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	1

Modifications	Class
6. Modifications of unconstructed units to comply with Secs. 264.221(c), 264.222, 264.223, and 264.226(d)	*1
7. Changes in response action plan:	
a. Increase in action leakage rate	3
b. Change in a specific response reducing its frequency or effectiveness	3
c. Other changes	2
Note: See Sec. 270.42(g) for modification procedures to be used for the management of newly listed or identified wastes.	
I. Enclosed Waste Piles. For all waste piles except those complying with Sec. 264.250(c), modifications are treated the same as for a landfill. The following modifications are applicable only to waste piles complying with Sec. 264.250(c).	
1. Modification or addition of waste pile units:	
a. Resulting in greater than 25% increase in the facility's waste pile storage or treatment capacity	3
b. Resulting in up to 25% increase in the facility's waste pile storage or treatment capacity	2
2. Modification of waste pile unit without increasing the capacity of the unit	2
3. Replacement of a waste pile unit with another waste pile unit of the same design and capacity and meeting all waste pile conditions in the permit	1
4. Modification of a waste pile management practice	2
5. Storage or treatment of different wastes in waste piles:	
a. That require additional or different management practices or different design of the unit	3
b. That do not require additional or different management practices or different design of the unit	3
6. Conversion of an enclosed waste pile to a containment building unit	2
Note: See Sec. 270.42(g) for modification procedures to be used for the management of newly listed or identified wastes.	
J. Landfills and Unenclosed Waste Piles	
1. Modification or addition of landfill units that result in increasing the facility's disposal capacity	3
2. Replacement of a landfill	3
3. Addition or modification of a liner, leachate collection system, leachate detection system, run-off control, or final cover system	3
4. Modification of a landfill unit without changing a liner, leachate collection system, leachate detection system, run-off control, or final cover system	2

Modifications	Class
5. Modification of a landfill management practice	2
6. Landfill different wastes:	
a. That require additional or different management practices, different design of the liner, leachate collection system, or leachate detection system	3
b. That do not require additional or different management practices, different design of the liner, leachate collection system, or leachate detection system	2
c. That are wastes restricted from land disposal that meet the applicable treatment standards or that are treated to satisfy the standard of "use of practically available technology that yields the greatest environmental benefit" contained in Sec. 268.8(a)(2)(ii), and provided that the landfill unit meets the minimum technological requirements stated in Sec. 268.5(h)(2). This modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	1
d. That are residues from wastewater treatment or incineration, provided that disposal occurs in a landfill unit that meets the minimum technological requirements stated in Sec. 268.5(h)(2), and provided further that the landfill has previously received wastes of the same type (for example, incinerator ash). This modification is not applicable to dioxin-containing wastes (F020, 021, 022, 023, 026, 027, and 028)	1
7. Modifications of unconstructed units to comply with Secs. 264.251(c), 264.252, 264.253, 264.254(c), 264.301(c), 264.302, 264.303(c), and 264.304	*1
8. Changes in response action plan:	
a. Increase in action leakage rate	3
b. Change in a specific response reducing its frequency or effectiveness	3
c. Other changes	2
Note: See Sec. 270.42(g) for modification procedures to be used for the management of newly listed or identified wastes.	
K. Land Treatment	
1. Lateral expansion of or other modification of a land treatment unit to increase areal extent	3
2. Modification of run-on control system	2
3. Modify run-off control system	3
4. Other modifications of land treatment unit component specifications or standards required in permit	2
5. Management of different wastes in land treatment units:	
a. That require a change in permit operating conditions or unit design specifications	3

Modifications	Class
b. That do not require a change in permit operating conditions or unit design specifications	2
Note: See Sec. 270.42(g) for modification procedures to be used for the management of newly listed or identified wastes	
6. Modification of a land treatment unit management practice to:	
a. Increase rate or change method of waste application	3
b. Decrease rate of waste application	1
7. Modification of a land treatment unit management practice to change measures of pH or moisture content, or to enhance microbial or chemical reactions	2
8. Modification of a land treatment unit management practice to grow food chain crops, to add to or replace existing permitted crops with different food chain crops, or to modify operating plans for distribution of animal feeds resulting from such crops	3
9. Modification of operating practice due to detection of releases from the land treatment unit pursuant to Sec. 264.278(g)(2)	3
10. Changes in the unsaturated zone monitoring system, resulting in a change to the location, depth, number of sampling points, or replace unsaturated zone monitoring devices or components of devices with devices or components that have specifications different from permit requirements	3
11. Changes in the unsaturated zone monitoring system that do not result in a change to the location, depth, number of sampling points, or that replace unsaturated zone monitoring devices or components of devices with devices or components having specifications different from permit requirements	2
12. Changes in background values for hazardous constituents in soil and soil-pore liquid	2
13. Changes in sampling, analysis, or statistical procedure	2
14. Changes in land treatment demonstration program prior to or during the demonstration	2
15. Changes in any condition specified in the permit for a land treatment unit to reflect results of the land treatment demonstration, provided performance standards are met, and the Director's prior approval has been received	[1]1
16. Changes to allow a second land treatment demonstration to be conducted when the results of the first demonstration have not shown the conditions under which the wastes can be treated completely, provided the conditions for the second demonstration are substantially the same as the conditions for the first demonstration and have received the prior approval of the Director	[1]1

Modifications	Class
17. Changes to allow a second land treatment demonstration to be conducted when the results of the first demonstration have not shown the conditions under which the wastes can be treated completely, where the conditions for the second demonstration are not substantially the same as the conditions for the first demonstration	3
18. Changes in vegetative cover requirements for closure	2
L. Incinerators, Boilers, and Industrial Furnaces	
1. Changes to increase by more than 25% any of the following limits authorized in the permit: A thermal feed rate limit, a feedstream feed rate limit, a chlorine/chloride feed rate limit, a metal feed rate limit, or an ash feed rate limit. The Director will require a new trial burn to substantiate compliance with the regulatory performance standards unless this demonstration can be made through other means	3
2. Changes to increase by up to 25% any of the following limits authorized in the permit: A thermal feed rate limit, a feedstream feed rate limit, a chlorine/chloride feed rate limit, a metal feed rate limit, or an ash feed rate limit. The Director will require a new trial burn to substantiate compliance with the regulatory performance standards unless this demonstration can be made through other means	2
3. Modification of an incinerator, boiler, or industrial furnace unit by changing the internal size or geometry of the primary or secondary combustion units, by adding a primary or secondary combustion unit, by substantially changing the design of any component used to remove Hcl/Cl<INF>2, metals, or particulate from the combustion gases, or by changing other features of the incinerator, boiler, or industrial furnace that could affect its capability to meet the regulatory performance standards. The Director will require a new trial burn to substantiate compliance with the regulatory performance standards unless this demonstration can be made through other means	3
4. Modification of an incinerator, boiler, or industrial furnace unit in a manner that would not likely affect the capability of the unit to meet the regulatory performance standards but which would change the operating conditions or monitoring requirements specified in the permit. The Director may require a new trial burn to demonstrate compliance with the regulatory performance standards	2
5. Operating requirements:	
a. Modification of the limits specified in the permit for minimum or maximum combustion gas temperature, minimum combustion gas residence time, oxygen concentration in the secondary combustion chamber, flue gas carbon monoxide and hydrocarbon concentration, maximum temperature at the inlet to the particulate matter emission control system, or operating parameters for the air pollution control system. The Director will require a new trial burn to substantiate compliance with the regulatory performance standards unless this demonstration can be made through other means	3

Appendix I to Sec. 270.42--Classification of Permit Modification (Continued)

Modifications	Class
b. Modification of any stack gas emission limits specified in the permit, or modification of any conditions in the permit concerning emergency shutdown or automatic waste feed cutoff procedures or controls	3
c. Modification of any other operating condition or any inspection or recordkeeping requirement specified in the permit	2

Modifications	Class
6. Burning different wastes:	
a. If the waste contains a POHC that is more difficult to burn than authorized by the permit or if burning of the waste requires compliance with different regulatory performance standards than specified in the permit. The Director will require a new trial burn to substantiate compliance with the regulatory performance standards unless this demonstration can be made through other means.	3
b. If the waste does not contain a POHC that is more difficult to burn than authorized by the permit and if burning of the waste does not require compliance with different regulatory performance standards than specified in the permit	2
Note: See Sec. 27042(g) for modification procedures to be used for the management of newly listed or identified wastes	
7. Shakedown and trial burn:	
a. Modification of the trial burn plan or any of the permit conditions applicable during the shakedown period for determining operational readiness after construction, the trial burn period, or the period immediately following the trial burn	2
b. Authorization of up to an additional 720 hours of waste burning during the shakedown period for determining operational readiness after construction, with the prior approval of the Director	[1]1
c. Changes in the operating requirements set in the permit for conducting a trial burn, provided the change is minor and has received the prior approval of the Director	[1]1
d. Changes in the ranges of the operating requirements set in the permit to reflect the results of the trial burn, provided the change is minor and has received the prior approval of the Director	[1]1
8. Substitution of an alternative type of nonhazardous waste fuel that is not specified in the permit	1
M. Containment Buildings	
1. Modification or addition of containment building units:	
a. Resulting in greater than 25% increase in the facility's containment building storage or treatment capacity	3
b. Resulting in up to 25% increase in the facility's containment building storage or treatment capacity	2
2. Modification of a containment building unit or secondary containment system without increasing the capacity of the unit	2
3. Replacement of a containment building with a containment building that meets the same design standards provided:	
a. The unit capacity is not increased	1

Appendix I to Sec. 270.42--Classification of Permit Modification (Continued)

Modifications	Class
b. The replacement containment building meets the same conditions in the permit	1
4. Modification of a containment building management practice	2
5. Storage or treatment of different wastes in containment buildings:	
a. That require additional or different management practices	3
b. That do not require additional or different management practices	2
N. Corrective Action	
1. Approval of a corrective action management unit pursuant to Sec. 264.552	3
2. Approval of a temporary unit or time extension for a temporary unit pursuant to Sec. 264.553	2

[1] Class 1 modifications requiring prior Agency approval.

[53 FR 37936, Sept. 28, 1988, as amended at 53 FR 37939, Sept. 28, 1988; 53 FR 41649, Oct. 24, 1988; 54 FR 9607, Mar. 7, 1989; 54 FR 33398, Aug. 14, 1989; 55 FR 22719, June 1, 1990; 56 FR 3928, Jan. 31, 1991; 56 FR 32692, July 17, 1991; 56 FR 7237, Feb. 21, 1991; 56 FR 32692, July 17, 1991; 57 FR 3496, Jan. 29, 1992; 57 FR 37281, Aug. 18, 1992; 58 FR 8685, Feb. 16, 1993; 58 FR 29886, May 24, 1993]

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